THE

# AMERICAN

# MEDICAL RECORDER.

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## I. UNIVERSITY OF PENNSYLVANIA.

THE following short description of the additions and improvements made in the building appropriated to the medical department of the University of Pennsylvania, during the last summer, cannot fail of being acceptable to every one who has its welfare at heart. The great importance of the science of medicine renders it necessary that its attainment should be facilitated by every means that can be devised. Next to the talents of its professors, nothing can be more essential to the interests of an University, than appropriate rooms for the delivery of the lectures. In this respect, few places in Europe can equal, certainly none surpass those, which, with a rapidity before unknown, have been erected by the board of trustees in this city. In size, in elegance, and convenience, they may safely stand in competition with any of the apartments, devoted to similar purposes, in the eastern hemisphere. Established now for nearly half a century, this University has been the focus from which other medical schools have originated, which preclude the necessity of a trans-atlantic voyage. Let us be permitted to hope, that it may continue its usefulness for ages yet to come.—Ed.

The accompanying engraving affords a view of the longitudinal section of the building, and the plans of the rooms.

Fig. 1.—Plan of the laboratory, on the ground floor, and of the chamber above it, for the professors of materia medica, and of the theory and practice of physic.

Fig. 3.—Plan of the anatomical theatre, appropriated to the professors of anatomy, of surgery, and of midwifery.

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"The following description of the very splendid edifice recently erected by the trustees of the University of Pennsylvania, for the use of the medical school, has been handed to us by Mr. Strickland, the architect employed on the occasion. In directing the public attention to it, we think it our duty to state, as an extraordinary instance of rapidity in the execution of a work, that this immense structure was completed in much less than three months, from the time of the commencement of the enterprize. Nor is this the only praise to which Mr. Strickland is entitled. The work, we understand, has received the approbation of the medical professors, strongly expressed; and we have reason to believe, as regards the beauty, the order, the convenience of its internal economy, this building, for the purpose it is designed, is not surpassed by any in the world." *U. S. Gaz.*

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"The Medical Theatre of the University of Pennsylvania is situated on the south flank of the University, at the distance of ninety-three feet west from Ninth street. During the last summer, this building has undergone a total change, as well externally as internally. It now contains three lecture rooms, immediately over each other, with appropriate apartments, galleries, and passages of approach. The plan is a parallelogram of ninety feet by forty-eight, having a semi-hexangular termination on the south. The two lower rooms are upon the same plan as to the

construction of the seats, which rise five feet in forty in the whole width of the building, leaving seven feet of a passage, circumscribed by a range of pillars sixteen feet in height. These rooms are lighted by semi-circular windows, elevated sufficiently from the floor to admit the light above the heads of the class.

"The upper lecture room, appropriated to anatomy and surgery, is an octangular amphitheatre of seats, which rise every way from a forum in the centre of the building, on nearly an angle of forty degrees. The approach to this forum is under the seats, at the height of seven feet six inches; being separated entirely from the passages of access, which are also under the seats, on the north and east sides of the buildings. These passages are wide enough for five persons to walk abreast, and lead to stair-ways which land upon the upper gallery that surrounds the amphitheatre. This room is sixty-five by forty-six feet, brilliantly lighted up by six large sky-lights through the roof on the east and west sides of the building, disposed at such an angle as to admit the direct rays of light upon the forum below. The effect produced by this concentration of light to the middle of the room enables that part of the class, which is the most remote from the lecturer, to distinguish objects more clearly, from their being situated in a much stronger light. Each of the lecture rooms is calculated to hold, with great facility, from eight hundred to a thousand persons, with every accommodation as to light, heat, and ventilation; and though of such large dimensions, it has been found, on trial, from the excellence of their construction, a voice of very moderate power may be distinctly heard in every part of them.

"To the improvements already mentioned may be added, a very spacious apartment, intended as a museum for the collection of the professors of anatomy and surgery; and a hall, for the use of the students."

## II. *Observations on the Goitre.* *By James Mease, M. D.*

The disease described in the following paper is connected most intimately with an important portion of our agricultural fellow-citizens, and deserves their serious attention. Exclusively of the numerous causes of disease to which an agricultural life is peculiarly liable, from exposure to weather, and accidents arising from the indispensable labours of the field, in clearing land, and erection of habitations; it is to be regretted, that in some parts of our country, our cultivators are often attacked by the complaint of which I am now to treat; and although it is not of a mortal nature, yet it is extremely deforming and troublesome. The circumstance is the more to be regretted, inasmuch as females are particularly liable to the disease; a fact, that we are unable to account for, notwithstanding the accurate knowledge we possess of the anatomy of the part affected by the disease, and the very considerable advances that have been made in the physiology and pathology of the human frame.

I became possessed of the facts which I am to notice, in the following way:

The late Mr. Samuel Breck, of Philadelphia, whose conversation was always of a useful tendency, and who never permitted an opportunity to escape of diffusing information, informed me several years since, that some female relations in an eastern state were annually affected by goitre; and that it uniformly and gradually disappeared, or nearly so, after a winter's residence in Boston, which was considerably remote from their regular place of dwelling. As I was struck with the fact, and induced to believe, that some useful deductions might be drawn from it, I asked permission of Mr. Breck to propose some questions on the subject to him, and requested him to endeavour to have them answered; this he politely promised to do, and the following is the result of his enquiries:

*Extract of a letter written by Mr. William Breck, of Claremont, state of New Hampshire, dated May* 20, 1808, *to Samuel Breck, of Philadelphia.*

"Yours of the 21st of March was duly received, and I offer this apology for my delay in not answering it at an earlier period. As the queries respecting *goitre* were new to me, I was led, in order to give a satisfactory answer relative to that complaint, to enquire of the most experienced physicians in this quarter, respecting it. In a letter from Dr. Trask, of Windsor, a gentleman much esteemed, a copy of which is subjoined, I received the most particular account, and now request you to present my respectful compliments to Dr. Mease, and communicate to him the whole, or such part of its contents as you may think proper."

Windsor, 12th May, 1808.

SIR,

In conformity with your request to answer some enquiries of Dr. Mease respecting goitre, I make you the following statement, which is all the knowledge I have on the subject:—In the winter of 1803–4, having finished my medical studies, and intending to commence the practice of physic, I visited the new settlements on Connecticut river, with a view of finding a place to establish myself for life. I began at Westmoreland, and there first saw the disorder which is the subject of Dr. Mease's enquiries. I did not stay long there, but travelled slowly up the river, examining with attention every village as I passed. I found the goitre a common disorder, and at Windsor in Vermont, where I finally settled, almost every *female* was affected with it. The patients themselves thought not much of it. The country was new: twenty years before this period, not a single tree had been cut in Windsor, nor had the least attempt been made at cultivation; it was at that time literally a howling wilderness. Soon after I came, inhabitants flocked into this and the adjacent towns, farms were rapidly cleared, the country every day assumed a more cultivated appearance, *the goitre gradually decreased, at present it is nearly extinct.* I thought it necessary to premise thus much before I answered the doctor's questions

more particularly. It appears to me, (I confess it is but conjecture,) that this disorder was somewhat connected with the new and uncultivated state of the country, for as this cause, if it was the cause, was removed, the effect was removed with it; all the patients recovered, and fewer cases occurred every day. Those who came *from the sea side were more liable to it than others.*

I will now answer the doctor's questions. The country is mountainous; limestone cannot be said to abound, though there is enough to supply the inhabitants for building. The disorder was not more common in the neighbourhood of limestone than in other places. The *fever and ague never originates* here, nor does any particular disease prevail throughout the year. It is generally healthy, and what, perhaps, is peculiar to this part of New England, the pulmonary consumption is a rare disease. The goitre appears at every age over eight or ten years. The water is as pure and soft as in any part of the world. The climate is the same as in New England in general; perhaps it is not so subject to drought in summer; there is much less snow, and the winters are much milder of late years than formerly.

Your friend, &c.

Mr. Wm. Breck. (Signed) NATHAN TRASK.

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The nature of the queries I proposed may be seen from the answers given; they referred in part to some theories of the disease that had been proposed by different medical men, and to other points I wished ascertained. The theories alluded to are, that goitre is caused, 1. by drinking snow-water, a notion that originated with Pliny, (Lib. ii. cap. 37.) 2. By the continued operation, but to a less degree, of the causes that excite intermittent and remittent fevers; this was first proposed by the late Dr. Benjamin S. Barton of Philadelphia. None of these will explain the cause of the disease in some countries where it is seen; for while it appears as frequently and as strongly marked in countries where snow water is exclusively or partially used, and in others where fevers constantly prevail; yet it is also equally troublesome in places where spring water is drank, and where fevers are

scarcely known. Thus, although it has been from the earliest times known to prevail in the vallies on both sides the Alps, in the mountains of Germany and Spain, and also is very common in Chinese Tartary;* yet it is rare in Scotland, but appears in the hilly county of Derby, and in the plains of Norfolk in England; in the hot unventilated vallies of Sumatra,† and in the vallies of Switzerland; it occurs in the cool glades of the county of Somerset in Pennsylvania; in the primitive soil of Alleghany county in Pennsylvania, and in the alluvial townships of Manlius and Onondaga, in New York. In Sumatra, and the two last mentioned places, fevers certainly do prevail, but the others are not remarkable for them; and in many districts where goitre is seen, intermittent fevers are little known. This is particularly the case in several parts of Pennsylvania and Canada; while on the extensive marshy coasts of the United States, which are noted for fevers of every type, goitre is unknown. As regards the influence of snow water, it may be further remarked, that the inhabitants remain free from the disease in the vicinity of the glaciers in Switzerland, where water from ice and snow is constantly used; while in Bern, according to Haller, a place remarkable for the purity of the water, it is very common. The water of a country may cause goitre, but it is more likely to originate from a state of the air, which we can no more account for, than for the prevalence of the swelled legs in Barbadoes, Cochin-China, and Thibet.

In most countries, goitre is connected with that species of mental imbecility, called cretinism; but in the United States, thanks to God, it is a mere corporeal affection.

The fact of the connection of the disappearance of the disease as the country is cultivated, is curious, new, and highly important; and cannot but be highly satisfactory to the spirited pioneers in our new settlements, who suffer privations and hardships enough, without the addition of a deforming disease, to deter them from subduing the wilderness. The fact is not only consolatory, but may serve as a powerful stimulus to greater industry, as well in effectu-

* Staunton's Embassy, vol. 2, p. 62. Philad. 1799.

† Marsden's Sumatra, second edit. p. 42.

ally draining and clearing the land, as in cutting down trees, or girdling them. In the one case, they obtain a speedy return for their labour, but do not insure health to an indispensable branch of their families; while in the other, they obtain greater produce from the earth, and at the same time they banish a disagreeable complaint.

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## III. *Observations on the neglect of supplying Vessels with Medical assistance, in long Voyages. By R. Harland.*

THE following observations are of a nature so highly important to the interests of humanity, that I take the earliest opportunity of making them public; hoping they may reach the notice of our common guardians, now assembled in congress; and trusting that they may be deemed fully sufficient to incline them to consider the subject noticed, with a view to the removal of a neglect so truly disgraceful to our country.—ED.

Philadelphia, November 21, 1817.

DEAR SIR,

It is with pleasure I embrace this early opportunity of communicating to you the result of my experience, on a subject which ought to command the attention of every one who feels himself interested in the cause of humanity. I allude to those abuses, under which a useful, though thoughtless, part of the community labour, by being deprived, on long voyages, of the benefit of medical assistance.

As the safety of the ship and passengers depends upon the exertions of the sailors, the health of the crew, one would suppose, should command the first attention of ship owners; their neglect, however, in this particular, is too frequent not to have attracted the notice of many. Having but just returned from a voyage of this nature, the circumstances which gave rise to the following observations, and the numerous evils arising from that neglect, remain strongly impressed upon my memory.

On the first day of November, 1816, the ship to which I was

attached, left the capes of Delaware. After a passage of 127 days we found ourselves in the port of Calcutta. On our arrival, we were surprised to find so many American sail moored in the river. This season proved unhealthy; and scarcely one of our crew escaped sickness. Being the only American surgeon in port, I had an opportunity of observing that we were not, in this respect, singular. Out of seventeen sail from the United States that lay, at one time, in this port, *not one*, except that to which I was attached, held a surgeon in their employ, although few, if any, had escaped disease at sea: most of them had either lost men at sea, or sent some sick to the hospital on their arrival; some had lost their captain at sea; others were obliged to put into some port, and leave their commander sick : all these vessels were from ports to the eastward of Philadelphia; many of them had a scarcity of medicines on board, and those of a bad quality; this, however, is of little importance, when we consider, that the best of medicines, in the hands of unskilful and ignorant practitioners, are no better than dangerous weapons in the hands of a madman. I have been witness to the melancholy effects of their improper treatment of diseases, originally mild in their nature, pampered into disorders the most virulent and complicated; I have seen the best of constitutions irrecoverably lost, features deformed, and limbs distorted, by diseases, from which, by timely and judicious administration of proper remedies, the unhappy sufferers might have been restored, with unimpaired constitutions, as useful members of the community. I might even say, (if rightly informed,) that death itself has followed the injudicious administration of medicines, or neglecting the proper time for administering them. Suppose, (as not unfrequently happens,) a mortal epidemic should take place among the crew soon after leaving the unhealthy shores of India, where they are generally exposed to every cause of fever, in working a ship out of rivers the most difficult to navigate. What confusion! what misery ! no physician to alleviate their pains, or to administer consolation; far removed from all relief, they are left to the horrors of a putrid disease, or miserable death; under these circumstances, should the weather prove boisterous, not only the safety of the ship, but the lives of all on board are endangered. Another inconvenience

arises from the avarice of ship-owners, and which, eventually, falls upon the thoughtless sailor; I have witnessed a new and healthy crew, arriving in these unhealthy climates; the sailor is daily exposed, in his customary occupations on ship-board, (and, of course, for the interest of his owners,) to that most general cause of disease, the sun; being taken sick, and having no physician attached to the ship, one is immediately employed; the bill, not unfrequently, amounts to a considerable sum, which is to be exacted from the small pittance due him, as wages. Should the poor fellow return home in the same employ, he will frequently find himself little bettered, perhaps worse, than when he left it; frequently, to avoid this exaction, they forsake their employ, and seek a passage home in other vessels.

I had frequent occasion to be called on board of ships, bound home, in order to give a last advice to those indisposed, and who were about to expose themselves to the mercy and inclemency of the sea; it was then, in particular, I observed the unprepared and dangerous situation in which some were about to withdraw themselves from all medical relief. Some I have observed labouring under the pain of that most detestable and nauseous disease, to which seafaring men are particularly liable, and which in its ravages, exceeds even that pest of mariners, the scurvy. The bad effects of exposing themselves in this situation to the mal-treatment of inexperienced men, and the importance and truth of this observation, are sufficiently obvious from the loss of a nose, perpetual ulcers, disfiguration of features, &c. to which such patients are subjected, and who, in this state are consigned to the hospital. Others, at this important period, are labouring under dysentery; the distressing, and oftentimes fatal effects, from neglecting this disease, are too obvious to need comment.

In fine, I never should end, were I to attempt to enumerate the many evils, arising from the sordid avarice of some ship-owners, who, from the fear of a trifling expense, expose the lives and constitutions of so useful a part of society to such imminent danger.

I feel highly gratified in having it in my power to state, that the merchants of Philadelphia have shown a liberality and interest

in this respect, worthy to be imitated by every philanthropist. To show that persons at sea are as liable to sickness as those on shore, I insert the following list of diseases, &c. with which the crew of the ship William Savery were afflicted, on our passage to and from India; viz. dysenteries, diarrhœas, hernias, fracture, luxation, hemorrhoids, wounds, furunculus, bilious fevers, sarcocele, hepatitis, dropsy, enteritis, rheumatism, paralysis, ulcers, lues venerea.—I have thus, in a concise and rough manner, thrown together the few facts I have witnessed, and should you think any of them worthy to be made public, I shall be happy, through you, in being serviceable in a cause that should interest us all; at the same time hoping you will make liberal allowance for the plainness of the composition, from the haste in which it has been written. I remain yours truly,

RICHARD HARLAN.

*Dr. Coxe.*

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## IV. *A case of Fracture of the Cranium, attended with a loss of Cerebral Substance. By John Wharton, M. D.*

Stevensburg, Culpepper County, Virginia, October 22, 1817.

SIR,

It is with pleasure I hail the appearance of a periodical journal calculated to promote the diffusion of medical knowledge. I, therefore, as a member of the great community of medicine, wish, as far as my abilities will admit, to contribute to the general stock; and trust, that the zeal by which I am actuated, will plead an apology for any gross or palpable error. Yours, &c.

JOHN WHARTON.

*Dr. Coxe.*

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### CASE.

ON the 5th of June, 1816, I was called on to attend a boy about fourteen years of age, near this village. On my arrival, I found a

very extensive fracture of the cranium, situated immediately above the left frontal sinus. The fracture was very irregular, being occasioned by the kick of a horse. Through the fissure, or rather fissures, I plainly perceived that the *dura mater* was lacerated. The patient laboured under the usual concomitants of pressure upon the cerebrum, sopor, convulsions, and vomiting. I removed, by means of the forceps, fourteen pieces of bone, elevated the depression, and united the integuments slightly together, by means of the interrupted suture. Then, over the wound, I applied a dressing of simple cerate, to which was superadded a common emollient cataplasm. Upon examining the bones, after the operation was completed, there adhered to one of the detached pieces, a portion of the brain about the size of a large garden pea. In completing the operation, I did not find it necessary to employ the trephine.

June 6. I find, upon enquiry this morning, that my patient has rested tolerably well, but has vomited once in the night. His fever very inconsiderable. I took from him a small quantity of blood, and exhibited a dose of sulphat of soda. The vomiting I attributed to the pressure of the poultice, which I ordered to be discontinued. The vomiting did not again return; and on the fifteenth day from the infliction of the injury, he was perfectly well. I did not find it necessary, during my attendance, to repeat venesection, as he never had the slightest pain after the third day, nor did he take any medicine during the cure, the sulphat of soda excepted. He is now as well and hearty as any boy of his age, and does not labour under the smallest inconvenience from this formidable attack. This case plainly proves the fallacy of the long received opinion among mankind, learned as well as illiterate, that the slightest injury of the brain was followed, in *all cases*, by death: an opinion, since proved to be erroneous, and which was too frequently pregnant with fatal consequences. The poor being, whose brain happened to be injured, was already "*numbered with the dead*," and the surgeon often found a *salvo* for his carelessness or ignorance, beneath the popular shield of long established error! Modern dissections have plainly proved, that *all the brain* is not essential to life. The reader will find some very valuable information on this subject, in a learned and ingenious work, pub-

lished a few years past, by Sir E. Home, of London. As the object of this paper is to convey a practical fact, I wave all speculation in the following adage :

"Res certissima, causa latet."

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## V. *Observations on Febris Puerperarum, by Ezra Michener.*

Philadelphia Dispensary, 11th. mo. 1st. 1817.

SIR,

IT is far from being my wish to supplant more important matter, but as it is presumed, that domestic will be prefered to foreign, and practical to speculative matter, I have been induced to offer the following paper, for the use of the Philadelphia Medical Recorder, if it should merit a place in its pages.

EZRA MICHENER.

*John R. Coxe, M. D.*

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IN the catalogue of diseases incident to humanity, there are few to be found which have excited more sympathy for the sufferer, more poignant anguish to rend the prospects of happiness, or which seem to strike with so much premeditated violence at the vitals of social pleasure, as the Febris Puerperarum.

It is foreign to the present purpose to enquire, whether the disease before us is epidemic or contagious; extensive observation, and rational induction, can only decide the question. But my intention is, to endeavour to corroborate, and confirm, that practice which bids fair to promote the cause of humanity, and to redeem our science from the opprobrium this disease has cast upon it.

That puerperal fever is an inflammatory disease, attended with local inflammation, a careful observance of its symptoms is sufficient to prove to an unbiassed mind; but we have a still more obvious reason for this deduction, in the success which attends the application of depleting and antiphlogistic remedies. Nor is the debility, or even typhoid state of the system which has been

so often known to supervene upon the first stage of the disease, an objection to that opinion. It is nevertheless probable, that it may sometimes assume the typhoid type at its commencement; where this is the case, the treatment must be varied accordingly. But it is more probable, that a state of indirect debility, brought on by the excessive violence of action, has been the one so long and unsuccessfully treated with tonics, and even the diffusible stimulants, without one single effort to remove the cause. Whether the rapidity of inflammation in the uterus, in this disease, is owing to its susceptibility of impression after the high excitement occasioned by its expulsive efforts, and the abstraction of the stimulus of distention, or to some other cause, we cannot say; but repeated observation has proved that its progress is astonishingly rapid. Hence we would draw the practical lesson, to use the most prompt and decisive means, at the commencement of the disease, to arrest its progress and prevent the debility which would otherwise follow.

Perhaps the circumstances of the following case may serve to elucidate the preceding observations.

Esther Cooper, a woman of colour residing in seventh below south street, was delivered of a healthy child, on the 17th of the 8th month last, after a severe labour of about thirty-six hours, which had been rendered tedious and painful by a projection inwards of the tuberosity of the left ischium. With the exception of copious bleeding, no particular plan was pursued, but nature permitted to effect her own ends. Her previous labours, four in number, had been like the present, slow and painful. Slight after-pains continued for a few hours only. The lochia were natural, and she seemed to be rapidly recovering. On the second day, she took some aperient medicine.

On the 21st at noon, (being, as she supposed, quite recovered,) she took a moderate meal of beef steaks, and warm half-baked bread. Soon after dining, she felt some wandering pains in the abdomen, which she denominated colic. To relieve this affection, she had immediate recourse to a family prescription of hot toddy.

About 4 o'clock, P. M. she was suddenly attacked with severe

rigors, pain in the head, back, and hypogastrium; delirium, incoherent muttering, and frequent fits of loud laughter. From what has already been said, it would appear, that her system, strongly predisposed to the disease, was easily excited thereto by the causes just mentioned. I did not see her until 9 in the evening, which was five hours after the attack, and ninety-two after delivery.

I found her in a state of high delirium, talking much, and laughing incessantly, with a total indifference to every thing around her. Countenance flushed, eyes red and watery, skin hot and parched, respiration somewhat hurried and laborious, pulse 130 in a minute, small and somewhat corded; and the uterus, which was enlarged, extending midway from the pubes to the umbilicus, was extremely sore to the touch, as evinced by her motion whenever I made pressure on the abdomen, and also by the burst of laughter it uniformly produced: The lochia were somewhat diminished in quantity.

Having previously determined on the proper mode of treatment, I opened a vein in each arm, and then sat down to observe its effects on my patient. After some time the laughing became less constant, and finally ceased,—and so of the muttering: she then began to perceive objects around her, and could soon describe her feelings; her pulse became more full and soft, descending at the same time to 100 strokes in a minute, and a gentle but general perspiration succeeded to the dryness of the skin, when the bleeding was stopped. On examining the quantity of blood drawn, which till now had been disregarded, I found thirty-six ounces.

This evacuation left her in the proper use of her senses, and almost free from pain; but the enlarged uterus gave her much uneasiness on pressure or motion. I now directed, Sulph. Magnes. ℥i. Tart. Antimon. gr. 1. to be taken immediately, with warm beverages during the operation of the medicine.

22d. The medicine has operated well, stools dark and fetid, blood sizy. Free from pain, pulse 80, and soft, her skin moist, and the tumefaction and soreness of the uterus much diminished.

23d. Remains convalescent. The soreness and tension of the

℞. Nit. Potass. ℥i. Tart. Antim. gr. iss. M. ft. pulv. in chart. 6. dividend.—One every two hours.

uterus having disappeared, a slight degree of debility was only left for removal; to fulfil which indication I had recourse to the following:

℞ Sal Tartari - - - - - - - - ʒi.
Pulv. G. Arab. - - - - - - - ʒss.
Tr. Cort. Peruv. Comp.
Aq. Cinnamom. āā - - - - ʒi.
— Fluvial. - - - - - - - ʒiv.—M.
Ft. Mistura.

A spoonful three or four times a day.

24th. Medical attention no longer necessary.

One of the most singular phenomena that presented in this case was, the transcendency of excitement above the point where pain is felt, and the pleasurable feelings are excited. That this was the case, was fully proved by the increase of laughter when the inflamed viscus was pressed.

It was also curious in the extreme to watch the effects of bleeding on a system so highly excited, and to mark the inverse ratio between pain and pleasure, the former increasing as the latter abated, from the loss of blood.

To offer any further observations on this subject, would perhaps be as superfluous as presuming in so young a man.

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## VI. *On the Utility of Blisters to the Neck in Epistaxis, by Dr. Robert Archer.*

Norfolk, September 27, 1817.

During my attendance at the General Hospital, in this place, in the month of October, 1814, a young man aged about 22 years, serving a tour of duty in a militia company, was admitted, labouring under *epistaxis*, succeeding an attack of dysentery, which raged very violently at this time in camp and garrison, and by which he had been reduced almost to the grave.

From the history of his case, as delivered by himself, it appears that he had been affected for some weeks with dysentery, but was getting better, when his nose commenced bleeding; that the surgeon of his regiment had done all he could to arrest the

hæmorrhagy, and that he was now reduced to that extremity, as not to be able to stand, his nose having continued to bleed, without the least intermission, for five or six days.

I instantly ordered a strong solution of sulph. cupri, to be injected into the nostrils, which had no effect. I then prescribed sulph. zinci.—acet. ceruss.—both internally, with opium, and as an injection, but to no purpose. The hæmorrhagy was occasionally arrested for a moment, by *deliquium*, upon the least exertion; but, as soon as he revived, it returned with its accustomed vigour.

After having employed, in addition to the above means, every remedy my imagination could suggest, with the exception of compresses introduced by the fauces, which could not be borne, from the extreme sensibility of the parts; I applied a large blister to the back of the neck. This was on the fifth day of admittance, and tenth or eleventh of the disease.

The blister produced an astonishing effect, for it no sooner began to vesicate, than the hæmorrhagy ceased, as if by a charm. The patient now began to recover rapidly; but it was a short respite; for the bleeding returned as violently as ever, as soon as the blister healed, which was in about a week after its application.

This circumstance was an inducement to renew the blister, which was accordingly done, of the same size, and on the same scar with the former. The effect of this was similar to the former; and, in order to prevent its healing, and to insure a permanent cure, I directed the blister to be dressed daily with a thin plaster of basilicon, sprinkled with a little powdered cantharides. In addition to this, the patient took pulv. cinchon. with carb. ferri, and wine, and continued this course, recovering gradually his strength, and was finally discharged, perfectly cured, about two months after his admission.

It may be said, that this was a case of passive hæmorrhagy, and although blistering may be effective in this, it may not be in the active kind. But this objection will be removed, when I state that I have employed it since in the various forms and periods of the disease, always with the same success.

Dr. Thomas appears to have lately experienced the beneficial effects of this practice; for in the last edition of his "*Practice of*

*Physic*," republished in New York, in 1815, he advises, in obstinate cases, the application of blisters to the neck; a remedy which was noted in none of his former editions.

ROBERT ARCHER.

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## VII. *On the Influence of Music on the Mouse.*

ON a rainy evening, in the winter of 1815, as I was alone in my chamber, I took up my flute, and commenced playing. In a few minutes my attention was directed to a mouse that I saw creeping from a hole, and advancing towards the chair I was sitting in. I ceased playing, and it ran precipitately back to its hole. I began again shortly afterwards, and was much surprised to see it re-appear, and take its old position. The appearance of the little animal was truly delightful, and at the same time wonderful. It couched itself on the floor, shut its eyes, and appeared to be in ecstacy. I ceased playing, and it instantly disappeared again.

This experiment I repeated frequently, with the same success; observing that it was always differently affected, as the music varied from the slow and plaintive, to the brisk or lively. It finally went off, and all my art could not entice it to return.

This case may add some weight to the evidence of others on this subject, particularly as it is held in derision by many; and Gmelin himself, not believing, with Linnæus, that "mus delectatur musica," has omitted this part of its history from his edition of that author's Systema Naturæ.

*Dr. Coxe.* ROBERT ARCHER.

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The above communication is, I apprehend, sufficient to establish the strong powers of observation of the illustrious Linnæus, even were no other concurrent testimony on record as to the fact. We have, however, a very interesting communication of a like nature, in the first volume of of the late Professor Barton's Philadelphia Medical and Physical Journal, p. 37, and which not being of any great length, I may be pardoned for introducing here, especially as

the influence of the music was even more extraordinary than in the case above related, for it produced the death of the little animal.—Ed.

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*Memorandum concerning the influence of Music on the common Mouse. Communicated to Dr. Barton, by Samuel Cramer, M. D. of Jefferson County, in Virginia.*

The following circumstance was related to me by a gentleman of undoubted veracity.

One evening, in the month of December, as a few officers on board of a British man of war in the harbour of Portsmouth, were seated around the fire, one of them began to play a *plaintive* air on the violin. He had scarcely performed ten minutes, when a mouse, apparently frantic, made its appearance, in the centre of the floor, near the large table which usually stands in the ward-room, the residence of the lieutenants in ships of the line. The strange gestures of the little animal strongly excited the attention of the officers, who, with one consent, resolved to suffer it to continue its singular actions unmolested. Its exertions now appeared to be greater every moment. It shook its head, leaped about the table, and exhibited signs of the most ecstatic delight.

It was observed, that in proportion to the gradation of the tones to the soft point, the ecstacy of the animal appeared to be increased, and *vice versa*. After performing actions, which an animal so diminished would, at first sight, seem incapable of, the little creature, to the astonishment of the delighted spectators, suddenly ceased to move, fell down, and expired, without evincing any symptoms of pain.

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Facts somewhat similar to the preceding, but not (that I know) so circumstantial, are recorded by different authors. Linnæus notices the circumstance in two words. Speaking of the common mouse, (mus musculus,) he says, "delectatur musica."—*Systema Naturæ*, &c. tom. i, p. 83, No. 13. Gmelin, in his edition of the System, omits this part of the Linnæan history of the animal. Barton.

## VIII. *Extraordinary Case of a Wound of the Abdomen, successfully treated, by Dr. William Shaw.*

DEAR SIR,

ACCORDING to promise, I send you for publication in the American Medical Recorder, the following case.

On the 28th day of April, 1810, I was called to see the wife of David Roberts, aged about sixty-two years, then living on Col. William's Farm, three miles up the Canal Road, who had been shockingly gored by a cow. It was about the dusk of evening when I arrived at the house, where I found Mrs. R. lying on the bed, much exhausted, and very cold. Having previously made inquiry respecting the nature of the accident, I proceeded to examine the abdomen, when, to my astonishment, I found a wound of full sixteen inches in length, commencing in the right hypochondriac region, and taking a direction down to the pubes, from thence up the left side, to the left hypochondriac region. Mrs. R. was a fat woman, and there being a deep crease in that part of the body, caused by two folds of skin, filled with adeps, the horn was guided in its direction, and the upper fold immediately falling on the lower, from its weight prevented the contents of the abdomen from protruding. I was desirous to know if the parts within were much injured or deranged before I commenced with my dressings, and to that end, introduced my hand and arm to near the elbow, but did not discover any thing materially wrong. On withdrawing my hand out of the wound, a considerable portion of fat followed, which I was unable to replace, and was obliged to remove it with the knife, in order to enable me to bring the sides into proper contact, and the edges of the skin together, so as to form a neat seam. This being done, I confined them in that situation by the interrupted suture and strips of adhesive plaster; over these were laid pledgets of lint, secured with the usual bandage. As she was much exhausted, I ordered her to have wine with a few drops of laudanum, and this to be repeated until her skin and extremities which were cold, became warm. The hemorrhage was but trivial, considering

the extent of the wound. I had but very little expectation, that my patient could survive so dreadful an injury long; but when I saw her next morning, to my great suprize, and no small gratification, I found her not only living, but quite cheerful; she had slept the greater part of the night. This morning a good nurse was employed, who gave her a purgative injection, which had the desired effect. As she had been accustomed to living on a vegetable and milk diet, the same was continued with but slight alterations. Every thing went on very favourably until the fourth day, when that point of the wound, where the horn entered, having suffered a severe contusion, showed symptoms of fast approaching mortification; to counteract which, I ordered the nurse to give her very freely of bark, wine, and laudanum, and to apply to the part, a poultice composed of powdered bark, brandy, and laudanum, which had the effect of checking the further progress of those very alarming appearances. The slough was thrown off by the assistance of a bread and milk poultice, and the part assumed a healthy aspect in a few days.

About the ninth day, the wound had all healed by the adhesive and anastomosing process, except the point of commencement, and a small part over the pubes, the edges of which I was unable at my first dressing, to bring into contact. The sutures or stitches, were now removed, and from this time my patient progressed rapidly in her recovery until the twenty-third day, when she was able to leave her room, and actually walked as far as the barn.

When we consider the extent of the injury done in this case, the parts concerned, the force required to produce it, and the result; we cannot withhold our belief in the special interference of Divine Providence. Here we have a very striking example of the vast, but mysterious power of nature in the animal economy; for she appears to have been determined not to yield up her sovereignty to any other, but to preserve her work by bestowing upon it that additional vitality necessary for its complete restoration.

I should not been willing to have given to the public a statement of the above case, on my own authority, if the subject of it was not still living in the neighbourhood; and were I not enabled to refer to several ladies of the first respectability in this

city, viz. Mrs. S.—, Mrs. S.—, &c. who, with their accustomed humanity, visited her often, and supplied her with every necessary during her illness.

Yours very respectfully,

WILLIAM SHAW.

*J. R. Coxe, M. D.*

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## IX. *An Anomalous Case. By W. E. Horner, M. D.*

Philadelphia, October 28, 1817.

DEAR SIR,

I HAVE selected the following case for the American Medical Recorder, because its novelty excited an unusual degree of interest in the physicians who attended. The detail of the symptoms, together with the appearances on dissection, may be serviceable on a future occasion. Should you, from these circumstances, deem it worthy of publication, it will give me pleasure to have contributed in this manner to the sphere of useful knowledge.

I am, with the greatest respect and friendship,

Your obedient servant,

W. E. HORNER.

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B. C. the subject of this memoir, aged 28, of a slender person and delicate habit, with high shoulders, small neck, flat breast, dark hair and eyes, and fair skin, contracted a venereal affection in Boston, in July 1815. In the following January he returned to Philadelphia, after a journey to Nova Scotia, during the excessive cold of the winter. The account he gave of himself was, that he had gone through a course of mercury while travelling, and had observed no other precaution against exposure, than clothing himself warm; that only a slight salivation had been induced, which caused but little inconvenience, and that his business, during the whole time, had never been interrupted by his disease.

It may be useful to state, that in 1811 he had an attack of hepatitis, which was cured by blood-letting and calomel. Immediately afterwards he had symptoms of a pulmonary affection, such

as cough and pain in the breast, for which his physician prescribed tar-water, and a spare diet. The symptoms disappeared, and he enjoyed from this period a moderate degree of health, but it never amounted to robustness. He used meats sparingly, seldom touched wine or spirits, and was in the habit of wiping himself every evening, just before going to bed, with a towel dipped in cold water. I now speak of the interval between his attack of hepatitis and of syphilis.

On the 7th of January, 1816, he returned to Philadelphia, cured apparently of the venereal. He complained, however, of a sore throat, and occasional fits of coughing. His body was much emaciated, and his strength impaired. By my advice, he inhaled the steam of warm water and vinegar, used frictions of vol. liniment on his neck, and took Barton's cough mixture, composed of the following ingredients:

℞ Syrup scill. - - - - - ʒij.
Ext. glycirr. - - - - - ʒiij.
Vin. antim. - - - - - ʒiss.
Elix. paregor. - - - - ʒij.
Aq. font. - - - - - - ʒviii. M.

A table spoonful every two or three hours.

This treatment was continued for several weeks, with little variation. He attended to his business as a merchant; and complaining but little, the disease was almost lost sight of, having been, according to his own account afterwards, sometimes better, and sometimes worse. About the 10th February, he was bled to the amount of 16 oz. and took sal. Glaub. ʒi. Observing, on the 1st March, that the disease was not relieved, I looked at his throat. An inflammation of an erysipelatous character, occupied all the posterior part of the pharynx, the palatine arches, the uvula, and the posterior half of the roof of the mouth. The principal uneasiness occasioned by this condition of the parts, was, a sense of soreness, and some difficulty in swallowing. The cough affected him at night, and after speaking. He was advised to use a gargle composed of alum, ʒiij. honey, ʒi. and water, ℔ss. and to omit the paregoric in his brown mixture, as he complained of its making him stupid and heavy in the morning. This treatment was

continued till March 20th, with but little benefit. The disease at this moment appeared trifling, but its obstinacy now rendered it a matter of serious consideration.

March 20th. His throat, besides the erysipelatous inflammation, has three or four small white ulcers, with edges somewhat elevated; there is a dusky redness in the inflammation, which, from the want of success in the use of astringent and discutient gargles, induced me to suppose, that it might depend on a debility of the vessels. Under this impression, I advised a stimulating gargle, as recommended by Dr. Thomas, composed of red pepper, vinegar, and water. His cough being still the same, I applied a blister to the breast, and ordered him to take a dose of salts. The brown mixture to be continued at night.

March 21st. He thinks himself better, but the affection of the throat and the cough appeared unabated. This state of things continued till March 29th. He took no medicine in the mean time, except the cough mixture at night, and the gargle, which was used four or five times a day. It is to be observed that, during this whole time, the patient had not confined himself to the house, but continued his customary avocations. On the evening of this day he expressed himself worse; and as he had been averse, till this time, to apply a blister over the throat, the necessity of which I had frequently urged, he now consented to it. A blister was according applied.

Perplexed at the obstinacy of this disease, and suspecting, from the small ulcers, some recurrence of the venereal taint, I applied for assistance. Dr. Parish was called in; the patient was now admonished of the impropriety of leaving his chamber, and requested to keep it closely, which he did.

March 30th. The throat still continues in the condition already mentioned; the cough is principally urgent at night.

℞. Pulv. myrrh. - - - - - - ℥iss.
Cort. Peruv. - - - - - - ℥ss.
Mel. despum. - - - - - ℥i.
Aq. font. - - - - - - - ℥vi. M. for a gargle.

*R.* Pulv. rhei, gr. xv. In case of not operating, to be repeated.

March 31st. A motion was procured by a single dose of the medicine. An accession of fever came on during the night; the

pulse is full and strong, cough occasionally troublesome, throat better in its appearance; difficulty and pain in swallowing somewhat increased.

℞. Sal Glaub. ℥i.

Gargle continued.—The fever remitted to-day about 12 o'clock.

April 1st. The salts operated well. On the evening of yesterday, another exacerbation of fever occurred, which lasted the greater part of the night—throat much improved in appearance—deglutition the same—cough troublesome at night. Gargle continued.

℞. P. cort. Peruv.—To be taken in the quantity of a tea spoonful every two hours in the forenoon, in any convenient vehicle.

April 2d. Symptoms the same as yesterday, medicine continued—a blister applied to the back of the neck.

April 3d. Seven o'clock in the morning. The patient complains of oppression of his breast, and difficulty of breathing. In attempting to swallow some tea, his respiration was suspended for a few moments: it appeared to depend on a spasm of the glottis; and with a view to immediate relief, I gave pulv. ipecac. gr. xx.; this, by exciting nausea and vomiting, had the desired effect. The last night was spent unquietly, in consequence of the fever returning. Throat has but few traces of inflammation left, the small ulcers have disappeared entirely. The difficulty of swallowing is still great. Bark discontinued.

℞. Sal. Glaub. - - - - - - - ℥i.

℞. Succ. limon,
Carb. potass, q. s. ad saturat.

One spoonful to be taken every two hours after the salts have done operating. At bed time, with a view to allay the cough, and procure rest,

℞. Tinct. opii - - - - - gtt. xxx.
Acet. scillit. - - - - ℥i.
Sp. nit. dul. - - - - ℥iss. M. pro dos.

April 4th. The salts operated well yesterday. The night was spent unquietly. A considerable discharge of saliva has come on. A repetition of the symptoms of strangulation occurred this morning, which was relieved in the same manner. Prescription of yesterday continued.

April 5th. Rested rather better than usual last night. Pulse is still full and active, with increased heat of the skin. Deglutition attended with extreme pain and difficulty, which are shown by the violent action of the muscles of the throat, and agitation of countenance in swallowing. The cough has now disappeared in a great degree. A slight swelling is visible on the neck, near the left parotid gland.

Fifty leeches were applied to the neck. Alkaline draught continued during the day—three tea spoonfuls of the tincture of hops substituted for the opiate at bed-time.

April 6th. Symptoms the same as yesterday, except the spasmodic affection. As but little if any progress towards a cure had been made as yet, the advice and assistance of professor Wistar were deemed requisite; and it was determined on in consultation, that the leeches should be applied again on both sides of the neck. The alkaline draught continued, and a gargle composed of borax, ℥i. water, ℔i., used frequently during the day.

The patient continued somewhat stationary for several days in regard to the affection of his throat, consisting in a difficulty of swallowing and impaired voice. He was pleased with the application of the leeches, and requested them again, which was granted on the 9th of the month. The swelling of his neck near the parotid gland on the left side continued to progress regularly; a similar swelling took place on the right, but not so large.

April 11th. The fever of the patient seems to have changed its remittent for a hectic type, shewing itself principally by profuse sweats, and a copious sediment in the urine. The local affection of the throat is stationary, except that there is now a considerable swelling in the neck on each side of the pharynx. The cough but seldom appears.

℞ Elix. Vitriol, gtt. xx. to be taken 3 or 4 times a day in a glass of cold water.

April 12th. A blister was applied to the fore part of the neck.

April 13th. The elix. vitriol discontinued, as he complained of its making him dyspeptic. Claret wine was allowed in small quantities, as he seemed faint, and in want of something stimulating.

April 14th. The patient's throat was now considerably swelled on both sides, in a direction a little anterior and parallel to the sterno-cleido mastoideus, and extending from the angle of the jaw to an inch and a half or two inches from the sternum. The swelling was indurated, and seemed to involve the lymphatic glands. An obscure fluctuation was felt just over the thyroid cartilage, but so very indistinct, as not to justify the puncturing of the part. The difficulty of swallowing was still great, and the voice much impaired. The pulse was now weak and quick, and the countenance much sunk. A distress in breathing had troubled him much of late, which, he said, seemed to proceed from an impurity in the air of his chamber, as if he could not get the full benefit of respiration. It may be observed here, that for the last fortnight the patient could only swallow a large mouthful with any tolerable convenience ; the muscles of the pharynx were probably incapable of grasping a smaller quantity, from the great rigidity produced by inflammation.

A second consultation was held to-day with professor Wistar; the subjects of it in a summary view were, the swelling of the neck, the night sweats, and the state of the respiration, together with a small tumour, which had just been discovered in the right side of the pharynx, and behind the posterior half arch of the palate. As means considered efficient had been fully tried, without the desired effect, it was determined to institute a course of mercury, and to apply another blister on the front of the neck.

April 15th. The exhibition of mercury was commenced, by giving four grains of calomel in divided doses, and the blister was applied.

April 16th. Patient the same, medicine continued. A copious suppuration had occurred on the blistered part. A strangury was brought on, for which parsley tea was given. At bed-time an anodyne glyster of tinct. opii ʒii. Flax-seed tea ℥ij was ordered, with a view to relieve the strangury, and to procure rest. The glyster had the desired effect in a short time. The patient was restless during the night, snored loudly when asleep, and awoke frequently. A short time before day-break he complained of a sense of suffocation.

April 17th. At 7 o'clock in the morning, his respiration was at-

tended with a hoarse rattling noise, the countenance cadaverous, and the eyes fixed ; his pulse to my surprise was full and strong. I raised him in bed. He had been elevated but a short time, when a convulsive suspension of respiration occurred. This lasted for 20 or 30 seconds, when he recovered his breath. The consulting physicians, Wistar and Parish, were assembled in half an hour, and professor Physic joined them. The pulse had now fallen. Though the patient's case was almost hopeless, they determined on doing every thing which their experience suggested. A blanket steeped in hot brandy was wrapped around his lower extremities and body ; enemas of ether and hot brandy given every half hour; and, at the suggestion of Dr. Physic, an attempt was made to pass a probang into the œsophagus through the nostril, with a view of throwing in stimulating medicines. The probang was easily introduced through the nares, and downwards for five or six inches ; but, when it got there, a gush of air through the tube indicated its lodgement in the trachea. Two more attempts were made to give the tube a right direction; but still the air passed through in a sensible current. Under these circumstances, it was thought advisable to desist. Death closed the scene at 1 P. M.

DISSECTION.

1st. An incision was made from the chin to lower end of the sternum, branching on each side along the margin of the ribs. A second cut over the thyroid cartilage opened an abscess, from which an ounce of pure pus was discharged. The finger being passed through this opening, discovered an abscess extending on the left side, to near the mastoid process, on the right to the angle of the lower jaw, and occupying the space between the os-hyoides and the lower end of the thyroid cartilage. The abscess contained about a half pint of pus.

2d. The integuments were dissected up on each side, from the lower jaw to the cartilago ensiformis, and the sternum with the cartilages of the ribs raised up: there was an universal adhesion of the lungs, on each side, to the pleura costalis. The lungs, on being cut into, seemed altered in their structure, being firmer than usual, and not collapsing much when their adhesions with the

pleura were torn asunder. On the right lobe, in the upper part, two small ulcers were seen, derived probably from tubercles, just passed into a state of suppuration. The pericardium contained about two ounces of serum. The heart was unusually large, and the coronary veins minutely distended.

3d. A scalpel was passed through the root of the tongue, about an inch and a half anterior to the os-hyoides, and the pharynx and larynx embraced in its sweep. The parts were then removed; on making the transverse section of the trachea in detaching it, a spoonful of pus was discharged. The pharynx was opened behind, and exposed its internal surface much inflamed; the epiglottis and arytenoid cartilages much tumefied; the epiglottis on the left side nearly $\frac{3}{8}$ths of an inch thick, the left arytenoid cartilage nearly the same thickness. The tongue was much rougher than usual at its root, its glands considerably enlarged. The fossæ, just before the epiglottis, filled up by the tumefaction. The larynx was opened from behind; a considerable inflammation existed in it and in the trachea; the ventricle of Morgani on the left side was completely obliterated, and on the right nearly so.

The contents of the abdomen were in a natural condition.

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## X. *On the Adulteration of British Malt Liquors. By James Mease, M. D.*

In the third volume of your "Medical Museum," 1807, I inserted a paper "On the Adulteration of British Malt liquors," in which I asserted, on the authority of English writers, and English periodical works of established character, that very injurious substitutes for hops and malt are made use of in their manufactures of malt liquors. These authorities were, The Agricultural and Commercial Magazine, vol. iii. p. 14.* Malcolm's Husbandry, vol. i. p. 292,† Barrow's Travels in Africa, p. 305,‡ Philips' Monthly Magazine, January, 1804.

* London 1800. † London 1805. ‡ London 1804.

I attributed these sophistications to the excessively high duties on hops and malt* and the high excise upon the liquor. I also proved that even in the most abundant hop years, the demand for them is greater than the possible supply; and concluded, that, owing to the adulteration of the articles, and the great perfection to which our own malt liquors had arrived, we ought to prohibit the use of British malt liquors to our patients. Afterwards, having occasion† to mention the manufactures of Philadelphia, I stated of our porter, that "its quality was truly excellent: to say that it is equal to any of London, the usual standard for excellence, would undervalue it, because as it regards either wholesome qualities or palatableness, it is much superior: no other ingredients entering into the composition than malt, hops, and pure water: and yet to a foreign porter-palate, accustomed to the impression left by the combination of the heterogeneous compound called English malt liquor, our home-brewed stuff will no doubt appear insipid." On the authority of the works I had before quoted, I stated, in a note, that the substitutes for hops and malt were tobacco, aloes, liquorice, quassia root and green vitriol. This passage has it seems excited some animadversion in England, and a friend lately from London informed me that a very respectable brewer in that city had controverted, in his presence, my position respecting the general adulteration of British malt liquors, and asserted, that, as far as regarded himself, it was not correct. With this qualification I am disposed to believe that the scandal will not universally apply; but that the fact is as I have stated, that is, that adulterations are common, I

* In 1802 the duty on malt per quarter (8 bushels) was 10*s.* 6*d.* and the excise on porter and ale was 6*s.* 4*d*; on small beer 1*s.* per barrel of 36 gallons. The excise in 1813 was 10*s.* per barrel on porter, and 2*s.* on the weakest small beer.* In 1816, Mr. Barclay, member from Southwark, stated "that in 1782 malt was 1*l.* 8*s.* 6*d.* the quarter, and the duty 10*s.* 6*d.* and now the price of malt was 3*l.* 5*s.* and the duty in round numbers 1*l.* 15*s.* Hops in 1782 were 40*s.* per cwt. and now were 6*l.* 8*s.* an increase of 300 per cent." "Howard's Debates in Parliament, vol. 33. April 8.

† Picture of Philadelphia 1810.

* Baverstock's Observations on the State of the Brewery, London, 1813.

continue to believe, not only from the reasons already advanced, but for additional reasons which I will now adduce.

1. In the Commercial and Agricultural Magazine, vol. 3d. p. 65, in addition to what was quoted from the same work in my paper already referred to, it is said,“ the publication of Mr. Browne, on the brewery, clearly points out the various substitutes which are used by the brewers, instead of malt and hops. The public should, therefore, be attentive to detect all such practices, and punish them.” Browne's work I have not seen.

Malcolm speaks in very bold language. In addition to what I formerly quoted from him, he says, vol. i. p. 293. “ In three casks of ale sent to the house of a late under-secretary of state in Westminster, there was discovered in each of the casks a large quantity of this tobacco (shag); the beer had most seriously disordered the mistress, housekeeper, and some of the other servants.”

P. 294. After speaking of the decline of the Hamburgh breweries, at the end of the 17th century, owing to the preference given to English beer and ale, he says, “ it was then *salubrious*, *nutritive*, and exhilarating: it was pleasant to drink, and free from noxious ingredients. But that *trash* now called porter, is the reverse. In the mouth the porter has some flavour, but in the stomach it is cold, vapid, and unwholesome: it prevents digestion, and gives rise to numberless complaints.” p. 295. “ I have been informed by a friend in the custom-house, that of quassia, guinea-grains, Spanish juice, and the like, the importation is beyond all conception great, and increases every year, and the merchants who import them have repeatedly told him they are principally consumed by the porter breweries. No wonder, then, that they should declare they have three years stock of hops by them, when that article is found to give way to drugs, the produce of other countries. It is not long since a large quantity of drugs, but of what kind I have now no recollection, were seized at a brewer's in the borough of Southwark.”

The new method of compounding porter, is now carried on to the highest pitch of perfection. The compounders are saved all that trouble which brewers were formerly put to, of keeping their casks in cellars for a length of time, during which they had to wait until

it became seasoned, keeping so much capital idle and locked up. All the seasoning stuff is now ready made, by chemical gentlemen, whose trade it is to prepare it: as it is for others to take off the stale and sour beer, and by a process peculiar to themselves, to manufacture it afresh, and thereby to make it vendible. This compound is taken and mixed with another liquid, recently made from a small quantity of malt and hops, and from that union of these ingredients that once famous liquor, porter, is now made.*

In the biographical notice of the late Humphrey Jackson, in the abridgment of the Phil. Trans. Royal Society, London, vol. xiii. p. 362, it is said, that he set up as a general instructor of the brewers, to initiate them into these new mysteries.

"Mr. J. kept a chemist's shop about Tower Hill, London, where, speculating on schemes how at once to make a great fortune, he fell on that of brewing porter, by certain drugs, substituted as materials, instead of malt and hops. With these, he set up as a general instructor of the brewers, to initiate them into these new mysteries, for saving malt and hops, by giving private lessons in the art, at an enormous premium. This art, it seems, they have, in most instances, practised ever since, in so extensive a manner, as to have produced a general complaint, that the ancient national malt liquor is miserably degenerated. Among other pupils of Mr. J. was the late Mr. Thrale, the great brewer in the Borough, from whom alone this charlatan extracted an ample fortune, as mentioned by Mr. T.'s widow, now Mrs. Piozzi, in her Anecdotes of the Life of Dr. Johnson."

In the "Pamphleteer," vol. vii.† are presented a series of letters on "Public-House Licensing," in London, which originally appeared in the Times newspaper, under the signature of "A Ma-

* Mr Malcolm mentions a brewer in Southwark who, in 1803, made his beer far superior in strength and flavour to any in London, (an honourable exception to the general practice) and yet it was retailed at 4*d.* per quart, while the inferior beer of others retailed at 4½d. He adds further in a note, vol. i. p. 295. "At a late trial before Lord Ellenborough, between a brewer and a publican, the latter being asked by his lordship, what he meant by *old beer*, replied, it was neither porter nor ale, but a *composition with which their trade was furnished by certain chemists*, to improve the flavour of their stale beer."

† London, 1816.

gistrate for Middlesex," and intended chiefly to show the great evils, corruption, partiality, and injustice to the public, arising from the conduct of " certain individuals, (justices,) who *lead* in licensing public-houses," and " whose acts are aloof from revision," and in the continuance of the custom of " brewers and distillers being the owners of public-houses." He adds, " Several of the great brewers have each from 50,000*l.* to 100,000*l.* taken up in the purchase of public-houses; and the supply of a district being monopolized by one or more wealthy brewers, the neighbourhood are compelled to swallow the drink to which they are confined; *chemical* mixtures, affording somewhat of the pungency to the palate, warmth to the stomach, and froth and colour to the eye of real Intire, are therefore substituted for the genial decoction of pure malt and hops." In a note, the writer says, p. 115, " It has been for some years notorious, that chemical drugs and salts enter very largely into the composition of porter; but it is only since the recent discoveries in chemistry, that malt and hops were found to be scarcely necessary for making malt liquor. About two years ago, a decayed brewer travelled through the country, offering, for a certain fee, to teach the innkeepers how to make one bushel of the old fashioned ingredients go as far as ten;——among his substitutes were oil of vitriol and copperas!"

To show that no secret is made of the artificial composition of porter, I may quote from a small treatise, entitled " Every man his own Brewer," by Childs, an English brewer, the following receipt to brew porter:

1 quarter (8 bushels) malt,
8 lbs. hops,
6 lbs. treacle,
8 lbs. liquorice root,
8 lb. essentia bina,
8 lb. colour,
Capsicum, $\frac{1}{2}$ oz.
Spanish liquorice,
Cocculus Indicus, 10 lbs.!

Salt of tartar, 2 drachms, (120 grains,)
Heading, ¼ oz.
Ginger, 3 oz.
Lime slacked, 4 oz.
Linseed,
Cinnamon.

*Essentia bina* is moist sugar boiled to a black thick syrup, and extremely bitter.

*Colour* is moist sugar boiled till it obtains a middle state between bitter and sweet, and gives to porter that fine mellow colour, usually so much admired in good porter.

*Heading* is a mixture of half alum and half copperas, and is so called, from giving to porter the head or froth.

*Cocculus Indicus* is a poisonous intoxicating East India drug, used to poison rats, and to intoxicate fishes, being mixed with dough.

*Quassia.*—Dr. Richard Pearson, of London,* speaking of the root quassia, says, "Of late years, this drug has been very generally employed in this country, (England,) in public and private brewing, as a substitute for hops, to the great prejudice of the people's health. For although, as a simple bitter, quassia is preferable to the hop for most medicinal purposes, yet for economical uses, and particularly for brewing, the hop is greatly superior to the Surinam wood. Mere bitterness is not the only quality which is wanted in brewing, nor the only one which the hop possesses: it is also astringent and aromatic to a considerable degree, properties which greatly increase its antizymic powers, and which are altogether wanting in the quassia. Hence malt liquor bittered with this last vegetable is not only less depurated, less clear, but it is at the same time apt to run into the acetous fermentation, and to lose all its mild and nourishing qualities. It spoils in half the time that hopped malt liquor does. This circumstance has contributed in no small degree to those bowel complaints that have prevailed so much during the last seven or eight years."

* Practical Synopsis of the Materia Medica. London, 1808, p. 391.

The quotation from Barrow's travels was to show the great increase of the cultivation of the aloes plant at the Cape of Good Hope, owing to the demand for the extract by the London breweries; and the following remark, on the subject of the same plant, is made by Dr. Duncan, jun. in the last edition of the Edinburgh Dispensatory, 1816:—

"During the first four years that the Cape of Good Hope was in possession of the British, more than 300,000 pounds, the produce of that settlement, were imported into England; and as this quantity was infinitely greater than could be required for the purposes of medicine, it is not improbable that, as Mr. Barrow states, its principal consumption was by the London porter brewers."

The following paragraph I extracted from a late English paper:—

"*Brewers.*—The legislature, during the last session of parliament, in *repealing* the act for allowing the manufacture and use of a liquor prepared from sugar, for colouring porter, has enacted, that, 'After the 5th of July, 1817, no brewer, &c. shall receive into his custody, or put into any wort or beer, any material for darkening the colour, other than brown malt, ground or unground, as commonly used in brewing: or shall have in possession any molasses, cocculus indicus, grains of Paradise, Guinea pepper,* or opium, or any article whatever, as a substitute for malt and hops,—all the liquor so mixed to be forfeited, with the cask containing it; and the brewer, for every such offence, to forfeit 200*l.*—No druggist shall sell such colouring to any brewer or dealer, under forfeiture of the penalty of 500*l.*'"

* Guinea-grains, called in the Brazils Malagenta pepper, is a native plant of that country, of Africa, and probably of other warm climates; the duty on which is stated to have been doubled in England, "as it is supposed to have been extensively employed in the brewing of malt liquor."—Fourth Report of the Directors of the African Institution, p. 16. Guinea-grains are, however, not unwholesome, being used to season the food of the natives: but the fact shows, that other materials besides hops and malt are used in brewing.

After reading the foregoing statements, I think no one can hesitate to believe, that the assertion made in 1807, respecting the adulteration of British malt liquors, was correct. Since that year, and even since the publication of my Picture of Philadelphia in 1810, the improvement in the manufacture of porter and ale, particularly the last, has been great; and they ought to be solely used by all those whose health require them, or whose constitutions will bear their stimulant effects.

# FOREIGN PAPERS, &c.

## *On the Analysis of Opium.*

*Of Morphium and Meconic acid, considered as essential parts of opium.* By Mr. Sertuerner, apothecary at Eimbeck, in Hanover. Translated from the French;—An. de Chimie & de Physique, of May, 1817.—Ed.

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It is nearly fourteen years since Mr. Derosne, apothecary, at Paris, examined opium, and published the results of his labours in the 45th volume of the *Annals of Chemistry*. Almost at the same time I occupied myself also in its analysis; but our results were so different and contradictory, that the object remained uncertain. Little attention was paid to my memoir; it was hastily written; the quantities operated on were small, and several persons repeated my experiments without success. Assured of the correctness of my labours in general, although undertaken at an early period of my life, and to obviate these contradictions, I commenced a second analysis of this singular vegetable substance, and have had the satisfaction to find my former observations confirmed, and to make some that are new. We shall see, as we proceed, that the process and observations of Mr. Derosne, in the analysis of opium, were not exact, and that he was not acquainted with the part essentially efficacious; for he took for this substance, which I call *morphine*, (*morphium*,*) that which was only a combination of it with the *acid of opium*. I am about to make known my observations, from which I flatter myself, chemists and physicians will derive some profit. They will throw light upon the principal characters of these two bodies,

* Called by some late English writers *morphia*.

and upon the constituent parts of opium; and I believe I have enriched chemistry with the knowledge of a new *vegetable acid*, (*meconic acid*,) and with the discovery of a new *alkaline base*, *morphium*, a very singular substance, which appears to approach to ammonia, and which will one day be united to the other salifiable bases. Although my former observations on opium and its constituent parts are confirmed, there are some facts which I have found to differ from those before announced; but this will be excused on account of my youth, and the small quantities on which I experimented.

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## I. *Of Morphium.*

1. Eight ounces of dried opium were digested with heat at several times with distilled water, until it was no longer coloured. After evaporation, a translucent extract was obtained, which became turbid by dilution with water; but by heat, or the addition of more water, the liquor regained its transparency.

This aqueous solution of the extract was saturated by an excess of ammonia, and a substance precipitated of a greyish white, which formed itself in granular translucid crystals. These crystals being often washed with water, are *morphium*, the efficacious part of opium, combined with a little extractive and *meconic acid*, as we shall see in the sequel.

2. This substance weighed 16 drachms* (gros) after drying. It was saturated with diluted sulphuric acid in slight excess; and was precipitated anew by ammonia, and was several times treated with this alkali to separate the extractive. But as this did not take place, it was reduced to an impalpable powder, and treated several times with a little alcohol, which was strongly coloured. I pro-

* The Paris pound contains 9216 Paris grains. It is divided into 16 ounces, each ounce into 8 gros, and each gros into 72 grains. It is equal to 7561 English troy grains; so that the French gros is a fraction less than the English drachm avoirdupois.—Ed.

cured in this way about eight drachms of morphium, almost colourless.

3. The small quantity of morphium dissolved in the alcohol, was separated by crystallization. The extractive matter, which was with the morphium in the alcohol, as well as in the ammoniacal liquors, was not pure extractive, but a combination of extractive with morphium, of which this was the base. It was very soluble in acids and in alcohol, but difficultly so in water, and it coloured the salts of iron green by its extractive, and separated a portion of its oxide by its morphium. As pure morphium is precipitated from its acid solutions, in form of a pearly powder, and crystallizes in parallelopipeds with oblique faces; I presumed it was the extractive, which combined with the morphium, that changed the form into a granular crystallization almost cubic. This idea was confirmed by treating this substance with ammonia. This dissolved a part of the extractive, which has the nature of an acid, and always retains the morphium; but it could not separate it entirely. Alcohol completed the separation, and dissolved the extractive which remained with the morphium. There is a great difference between the extractive matters separated by ammonia and by alcohol. The first dissolves readily in water, because it contains less morphium than the *brown* matter obtained by alcohol. In the one, it is the extractive which predominates; in the other, it is morphium. It is on this accouut we can give to the first, by a solution of morphium in alcohol, the appearance of a resinous body, in which the morphium predominates, and subserves the functions of a base. The aqueous extract of opium concentrated, always affords with ammonia these two combinations.

4. To obtain morphium completely pure, I dissolved it anew, several times in alcohol, and procured it by crystallization, entirely colourless, in regular parallelopipeds, with oblique faces. The substance obtained by treating opium with alcohol, after Derosne's plan, crystallizes in prisms, at angles of from 30 to 40 degrees, and strongly reddens the solutions of iron.

5. Pure morphium has the following properties: It is colourless, slightly soluble in boiling water, very soluble in alcohol and ether, particularly if aided by heat; these solutions have a very bitter

taste, and the morphium crystallizes in the form above mentioned. The aqueous and alcoholic solutions render paper, coloured with rhubarb, of a deeper brown than that with tumeric, and they restore the blue colour of litmus paper reddened by the acids. It is not ammonia that produces this effect, for pure morphium contains none, as we shall see in the sequel, by treating this substance with caustic potash.* It dissolves easily in the acids, and forms neutral salts, very remarkable, of which the following are some:

The *sub-carbonat of morphium* is formed by making carbonic acid act on morphium, or by decomposing its solution by sub-carbonat of potash.

The *carbonat of morphium* crystallizes in short prisms.

*Acetat of morphium* crystallizes in small rays, and is very soluble.

*Sulphat of morphium* is very soluble, and crystallizes in ramifications.

*Muriat of morphium* forms feathers or rays, dissolves with more difficulty than other salts with base of morphium, and by cooling it forms a brilliant mass of a silvery white, if the evaporation is carried too far.

*Nitrat of Morphium* forms in radii, shooting from a common centre.

I have not formed the *meconiat of morphium*, but the *sub-meconiat*. This salt crystallizes in prisms, and I procured it by treating with alcohol an aqueous solution of opium: It requires much water to dissolve it, and to separate it entirely from the opium.

*Tartrat of morphium* crystallizes in prisms much resembling those of the preceding salt.

These different salts formed by morphium, appear to me to be very injurious, for after tasting them, I always experienced a headach. They are pretty soluble in water, most of them have a micaceous lustre, and effloresce quickly in the air.

In the order of salifiable bases, morphium will rank after ammonia, for it is disengaged from all its combinations by that alkali. It will occupy the last place amongst the alkalies, from which it is

* Morphium and acid extractive have the singular property of forming, with alkalies and acids, quadruple combinations: the precipitates obtained by Derosne contained either ammonia or potash.

distinguished, in being less powerful, and in not possessing the property of saponifying the oxydated oils. It has less affinity for acids than ammonia, and even than magnesia; but it decomposes the greater part of the metallic salts, as the sulphat, muriat and acetat of iron, several of the salts with a base of mercury, lead and copper. Acetat of copper loses its green colour by morphium, and doubtless forms with it a triple compound, as with ammonia. It combines with the carbonic acid of the atmosphere, and with extractive, as the other salifiable bases.

Morphium readily melts by heat, and then resembles melted sulphur; it crystallizes by cooling. It burns briskly, and we obtain, by heating it in close vessels, a blackish resinous substance, of a peculiar odour. It combines with sulphur by means of heat; but it is destroyed in the same moment, whilst the sulphur is converted into hydro-sulphuric acid. I have not had time to exactly determine the elements of morphium; but there is no doubt it must consist of oxygen, carbon, and hydrogen, and perhaps also of azot.* The galvanic pile produces little effect on morphium, even when aided by a globule of mercury; yet the globule does appear to enlarge and to change its consistence.

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## II. *Of the Effects of Morphium on the Human Body.*

6. The most remarkable property of morphium is the effect it produces on the animal economy. To determine this with precision, the experiments were made on myself and other persons, because those made on animals do not afford exact results.

I ought particularly to fix the attention on the terrible effects of this new body, in order to prevent accidents; for it has been publicly

* I requested Mr. Lange, a young man well acquainted with chemistry, to examine the combinations of this remarkable substance with the acids, and I hope he will obtain results which will throw some light upon the other salifiable bases, because morphium contains carbon, which is not found in the other bases. Mr. L. will likewise describe some of the meconiats.

pretended that this substance has been given in considerable quantities to many persons, without any effect being remarked. If it was indeed morphium which was given in those cases, it will follow, that it was not dissolved by the gastric juice. My former experiments, of which, it would seem no knowledge was had, led me expressly to assert, that this substance should only be given dissolved in alcohol, or in a little acid, because it dissolves with difficulty in water, and of consequence that it is acted on with difficulty in the stomach, without the intermedium of those liquids.

In order to examine strictly my own experiments, I engaged three persons, none older than 17 years, to take the morphium with me. But admonished by the effects I had before witnessed, I gave to each only half a grain, dissolved in half a drachm of alcohol, diluted in several ounces of distilled water. A general redness, perceptible even in the eyes, covered their face, principally the cheeks; and the vital forces seemed augmented. After half an hour, when we took another half grain of morphium, this state considerably increased; and we felt a disposition to vomit, and a dizziness in the head. Without waiting the result, we again swallowed, after a quarter of an hour, an half grain of morphium in coarse powder, with some drops of alcohol, and half an ounce of water. The effect was instantaneous with the three young persons; they felt a sharp pain in the stomach, a weakness, and a general numbness, and they were ready to faint. I experienced similar effects. On laying down I fell into a state of reverie, and I felt a sort of pulsation in the extremities, principally in the arms.

These evident symptoms of true poisoning, and above all, the fainting state of the three young men, gave me such uneasiness, that I swallowed, without reflection, six or eight ounces of strong vinegar, and caused them to do the same. A vomiting succeeded, so violent, that one of us, of a delicate constitution, and whose stomach was entirely empty, found himself in a very painful situation. It seemed to me, that the vinegar communicated to the morphium this violent vomitive property. I gave then to this young man some carbonat of magnesia, which checked the vomiting. He passed the night in profound sleep. The next day the vomiting returned, but it soon ceased, after a large dose of carbonat of magne-

sia. The loss of appetite, constipation, numbness, head-ach, and pain of stomach did not disappear for some days.

If we may judge from this disagreeable experiment, morphium is a violent poison even in small doses. Its combinations with acids have, perhaps, still more effect. I believe the last half grain taken, had a more violent action, because it arrived concentrated in the stomach, and was there dissolved.

The other constituent parts of opium not possessing any of the properties of which I have made mention, it appears to me, that the principal effects of opium depend on the pure morphium. It is for medical men to examine this subject. Hitherto the combinations of morphium with meconic acid have alone been employed. We may likewise expect useful effects from the different salts with a base of morphium, in many diseases. My own experience has taught me, that a very violent tooth-ach which did not yield to opium, disappeared by the use of an alcoholic solution of morphium, although containing but little of it. The meconiat of morphium, which constitutes the efficacious part of opium, not being very soluble in water, we must employ only pure alcohol for tinctures of opium; we ought, likewise, not to let such tinctures be too much cooled, because in this case, the morphium precipitates in combination with the resinous parts, the extractive, and the meconic acid, and hence these remedies are weaker in very cold weather, than at a mean temperature. It is to be wished, that able physicians may soon employ themselves on this subject, because opium is one of our most efficacious remedies.

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## III. *Of the Acid of Opium, or the Meconic Acid.*

7. Having shewn the properties of morphium, we are now to examine the liquid from which it was precipitated by ammonia.

After evaporating it to the consistence of a syrup, a little morphium was deposited in irregular crystals. The ammonia formed a precipitate, which was scarcely any thing else but morphium; but which was redissolved in the extractive, if the ammonia was

disengaged by heat. This extractive has acid characters; but it cannot retain the ammonia at an elevated temperature, and combines with the morphium; a combination we are shortly to describe. After separating a little morphium by excess of ammonia, the extract of opium was filtered, and diluted with distilled water, from whence the ammonia was disengaged by heat, and a solution of muriat of barytes was added, as long as any precipitation appeared. The precipitate, washed and dried, weighed six drachms. It is a quadruple combination of barytes, morphium, meconic acid, and extractive, soluble in water with difficulty.

8. I endeavoured to separate the morphium from the extractive by alcohol, and to obtain the pure meconic acid in the liquid, by saturating the barytes with an adequate quantity of sulphuric acid. I obtained in fact the meconic acid by evaporation; but as it was coloured, I subjected it to sublimation. It melted at first in its water of crystallization, and sublimed in long and handsome needles. It was colourless, of an acid taste, had all the properties of strong acids, and was distinguished from them by its great affinity to oxyd of iron, which it precipitated from its muriatic solution of a beautiful *cherry-red*, even when it had a slight excess of acid. But it did not indicate the iron in the ferruginous prussiat of potash, as I formerly asserted, deceived doubtless by the intense colour of the acid I employed. Unfortunately the apparatus broke during the sublimation, and the small quantity of acid I had obtained was still further diminished, so as to prevent an examination of the salts it formed with the bases. I have only combined it with lime; it then forms an acid salt. The *meconiat of lime* crystallizes in prisms; it is but little soluble, and is not decomposed by sulphuric acid.

Meconic acid does not act on the system in a sensible manner: I have taken 5 grs. without experiencing any effect. It appears to me that it mitigates the effects of opium, and renders it more soluble in water, as do all the acids. I believe this property of acids is owing to their forming with morphium a salt with excess of acid; but nevertheless we see that the other salifiable bases are often more hurtful to life, combined with acids, than when acting

alone; and perhaps this may be the case with salts that have a base of morphium.

9. The liquid from which I had separated the morphium and meconic acid was coloured red, by muriat of iron and by sulphuric acid. By evaporating it to the consistence of syrup, I procured 40 grs. of a salt little soluble, from which I separated by alcohol a little morphium, which had been dissolved by the water, and was precipitated during the evaporation. In treating this salt by sulphuric acid, sulphat of barytes and meconic acid were formed. It was therefore *meconiat of barytes.*

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## IV. *Of the other Parts soluble in Water.*

10. Alcohol having dissolved so little of the morphium in the quadruple combination, I believed it was retained by the extractive. In fact, the extract from which I had separated the meconiat of barytes, after being diluted with water, and evaporated to the consistence of syrup, allowed the precipitation of about 30 grs. of a granular mass, which I recognised as a compound of extractive and morphium, and which was dissolved by alcohol, excepting a little of the meconiat of barytes, combined with it. Believing I had obtained the extractive pure, I gave 10 grs. at several doses to one of my pupils, who quickly discharged them by vomiting. A little ammonia caused a slight precipitate, which disappeared when the ammonia was disengaged by heat. I repeated this experiment several times. The precipitate formed by ammonia in the cold had the properties of morphium, and combined with the extractive, if the ammonia was disengaged by heat.

These results determined me to redissolve the extract in water; when it became turbid, as usual, I collected a little precipitate by filtration. It shewed itself to be morphium with much extractive; in fact, it was dissolved by the alcohol, and had the crystalline traces of morphium. When I added ammonia in excess, the precipitate was very great, and almost all the mass appeared as a ductile resinous substance, which, in a dose of 5 or 6 grs. produced

the same effects with extract of opium, but less considerable. This matter was little soluble in cold water; it decomposed the metallic salts like morphium; it was soluble in, and saturated the acids, and it deposited by ammonia, which dissolved much, a greyish mass, which was morphium with a little extractive. I endeavoured to precipitate the extractive with the morphium, by sub-acetat of lead, and to separate the morphium by alcohol; but I obtained only a little morphium coloured by extractive: the rest appeared to have formed a triple combination. When I decomposed the precipitate by sulphuric acid, the extract still shewed its hurtful effects; and by adding ammonia, traces of the resinous substances. It appears to me, that morphium has a strong affinity to extractive, which is perhaps much oxydated, and that it forms with it different combinations, one containing much morphium, which forms the crystals of which I have above spoken, the other containing much extractive, which is precipitated as a resin by ammonia, from the extract of opium separated from its acid and the morphium which it had dissolved. Although the oxyded extractive was combined in excess with morphium, the combination had nevertheless its principal properties; it was little soluble in water, very soluble in alcohol and in acids; it saturated these last, and was precipitated by ammonia, which, combining with the excess of extractive, formed a substance soluble in water. Nevertheless the extractive, which combines with the ammonia, contains still some morphium. I confess I ought to have attempted still further to have separated entirely the morphium, by ether, oil of turpentine, or absolute alcohol.

An artificial combination of extractive and morphium is produced, by dissolving morphium in alcohol, and treating it by extractive from another substance. It belongs to the properties of morphium and extractive to combine together, for the one has the character of a base, and the other of an acid.

### V. *Of the Parts insoluble in Water.*

11. Not having sufficiently digested the opium in water, I presumed that the residue of the opium still contained some morphium and meconic acid. I treated it therefore with half an ounce of weak muriatic acid and a sufficient quantity of water. After filtering the liquid, I added ammonia; and obtained, without counting that which remained in the liquor, about 2 drachms of morphium, combined with much extractive and a pulverulent substance. The ammonia which was added in excess was disengaged by heat. The liquid, treated by a solution of muriat of barytes, afforded by evaporation a small quantity of meconiat of barytes.

12. The residue, from which had been separated the extractive, the morphium and meconic acid, by means of the water and muriatic acid, weighed 1 oz. 5 drachms; it was almost pasty. I treated it with alcohol until this was no longer coloured. On adding water, and distilling the alcohol, I obtained a brown substance which had the aspect of a balsam; it swam upon water, and was little soluble in alcohol. It had the odour of fish, smoke-dried, and the taste of fat; it burned with a flame, which deposited much soot, and produced no effect on me or other persons, even in a dose of 20 grains. A little dog swallowed several drachms, without experiencing any hurtful effect. I digested one part of this residue with oil of turpentine, and another with sulphuric ether; and obtained, by distilling these solutions, a species of caoutchouc, which appeared to me still to retain a little of the brown substance, especially that obtained by the oil of turpentine.

On treating with diluted sulphuric acid, the residue of the opium deprived of all its soluble parts, I changed it into a mucous substance.

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### VI. *Results afforded by Treating Opium with Cold Water.*

13. As heat might have some influence on my results, and not having yet cleared up all that Derosne says respecting opium, I

changed my experiments as follows:—1000 grs. of powdered opium were triturated in a porcelain mortar, with small quantities of cold distilled water, added at several times. After some hours, I filtered the liquor, expressed the opium strongly, and continued this treatment until the water appeared colourless. This very diluted aqueous infusion evaporated very slowly, afforded an extract different from the first, in not being rendered turbid by the addition of water. But ammonia and the salts of iron equally indicating the presence of meconiat of morphium, I thought that this was an acid compound of these two new bodies, because the tincture of litmus was reddened by it. Alcohol does not decompose this salt; the extractive dissolves it.

14. The extract of opium by cold water was boiled for $\frac{1}{4}$ hour in a little water. The filtered liquor was strongly troubled by cooling, and resembled a decoction of Peruvian bark, but less coloured; and appeared to be sub-meconiat of morphium with a little extractive. It was deposited on the sides of the vessel in form of a brownish mass, in which were produced, after some time, prismatic crystals of meconiat of morphium.

15. The residuum was strongly digested by heat, with alcohol. The brown liquor, filtered, deposited, after cooling to +5°C. (41° F.) the salt described by Derosne. This salt restored, by its morphium, the colour of litmus paper, and acted feebly by the meconic acid, on the salts of iron. At the same time it deposited at the bottom of the vessel a coloured substance, which, treated by alcohol, gave a little sub-meconiat of morphium. The residuum, which was very soluble in alcohol, but scarcely so in water, contained the combination of morphium with extractive, and the brown matter of which mention has been made above, (12.) The combination of morphium with extractive is distinguished from resins by this property: nor can its extractive be separated without difficulty. Ammonia dissolved still less, and removes from this combination its solubility in water. The residuum, treated once more with alcohol, gives a coloured tincture, which is clouded by water, and is not rendered clear by acetic acid. The solution contained so little of the compound above mentioned, that its taste was scarcely bitter.

16. It results from these observations, that cold water dissolves

the meconiat of morphium with excess of acid, and most of the extractive, and that the residuum contains sub-meconiat of morphium little soluble in water, with a little extractive, which readily dissolves in cold alcohol, but deposits itself almost entirely in crystals.

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## VII. *Conclusions.*

17. Without speaking of those accidental mixtures, which are here unnecessary, but which I have noticed in my former rearches, *crude opium of commerce* is composed of *meconiat of morphium* a little acid; which is separated by cold water into *sub-meconiat of morphium*, little soluble, and into *acid meconiat of morphium*, very soluble in water, on the presumption that there are not other vegetable acids mixed, which redden litmus paper. The *extractive* is separated, like morphium, into two parts, of which one, which is free, dissolves in cold water; the other part, doubtless more oxyded, remains in the residuum, with the sub-meconiat of morphium, and forms, by digestion with alcohol, sub-meconiat of morphium, and a compound of morphium with extractive, nearly insoluble in water, but very soluble in the acids.

Hot water dissolves more of the morphium than cold water, and the morphium precipitates by the cold in the liquor, combined with a little meconic acid and extractive.

The resinous matter and the other constituent parts of opium have no influence on its medicinal properties, because they are scarcely soluble either in water or in alcohol.

There is therefore a great difference between *extract of opium* prepared by hot, and that made with cold water. The latter is more active than the former. The *tinctures of opium* ought to be prepared with pure alcohol, because it is only that which dissolves the compounds spoken of above. These tinctures ought not to be kept in situations where the temperature is too cold, because a little of the salt of morphium then precipitates. By adding a little acetic acid, these inconveniences are prevented, provided we are assured that acetat of morphium has the same medicinal properties with opium, or meconiat of morphium.

The extract of indigenous poppy heads, prepared with distilled water, affords no trace of morphium with ammonia, even with the addition of a little acetic acid. It appears that this plant contains morphium combined with extractive. I found no trace of meconic acid. Other chemists, who have examined opium, appear to have obtained different results.

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## VIII. *Appendix.*

I had proceeded thus far in my memoir, when I had occasion to make the following observations on the preparation of morphium and meconic acid.

1. Take 8 oz. of powdered opium, triturate them in the cold with 2 or 3 oz. of concentrated acetic acid and a little distilled water; dilute the paste with 2 or 3 lbs. of cold water, and filter the liquor. This solution slightly coloured contains acetat and meconiat of morphium, extractive, and traces of a combination of extractive with morphium.

2. Precipitate the morphium by ammonia, and evaporate the liquor to a fourth part; separate, after cooling, the morphium by filtration, and precipitate the meconiat of ammonia by a sufficient quantity of acetat of barytes. On evaporating the liquid to dryness, a little meconiat of barytes is deposited. The extract from which the acetats are removed by absolute alcohol is nearly pure extractive; I took 20 grains without the least inconvenience.

3. The residuum (1.) contains the combination of the extractive, in excess with morphium, little soluble in the water. I treated it at several times with sulphuric acid diluted with six parts of water, and decomposed the acid solution by ammonia. This decomposition is but imperfect, for there always remains some morphium with excess of extractive, (brown meconic acid,) and a trace of sulphuric acid. This *acid extractive*, or *brown meconic acid*, has no effect. It is only the morphium which communicates noxious properties to it.

*Conclusions.*

Crude opium contains then *neutral extractive* and *acid extractive*, both of which are devoid of effect on the animal economy. The last is combined with morphium; but it combines with the meconiat of morphium, and becomes soluble in alcohol. This combination is only partly decomposed by water; for the residuum contains traces of meconic acid, which, forming a triple compound with much morphium and extractive, is dissolved in water only by little and little. It is on this account that extract of opium prepared by cold water contains only a part of the meconiat of morphium, and a little of the compound of morphium and extractive. On adding acetic acid, this compound loses one part of its morphium, and the meconiat of morphium separates as brown meconiat of morphium.*

* I confess we ought to be surprised, after speaking of meconic acid, to find me distinguishing a second, which I denominate *brown meconic acid*; but such a step seems to me to be sufficiently exact, and very useful in the analysis of vegetables. It is now ten years since I proved in a memoir, that, besides the acids long since known, there existed a second order, which do not redden the tincture of litmus, and which form with bases various compounds. The greater part of the vegetable and animal colouring matters, and many constituent efficacious parts of medicines, belong to this order. I will mention the yellow acid of turmeric—those of Peruvian bark, of rhubarb and angustura, the brown acid of opium, the red acid of litmus, &c.

These demi-acids can be readily formed by the alkaline carbonats and subcarbonats, whose bases form with them peculiar salts, of easy decomposition, by treating their solutions with acetic acid; or, if the acid is soluble in alcohol, by sulphuric acid diluted. Amongst these salts, we ought to reckon litmus, carmine, brown meconiat of morphium, and its combination with meconiat of morphium and acetat of lead; red and black ink, the soaps, &c. The art of dyeing is principally occupied with these demi-acids and their combinations. We see in opium, that these demi-acids exert a great play in the analysis of vegetables; for it is the brown acid of opium, or oxydated extractive, which renders the separation of the constituent parts of opium so difficult, by forming a triple compound with morphium and meconic acid.

I have discovered that, by taking the necessary precautions, *morphium* crystallizes in truncated pyramids, whose base is a square or rectangle, and also often in prisms with a trapezoidal base. *Derosne's salt of opium*, or *meconiat of morphium*, crystallizes in prisms with a rhomboidal base, which are connected with each other under an angle of 50° or 60°

*Observations by the* (French) *Translator.*

We are surprised that the former memoir of Mr. Sertuerner had not more attracted the attention of chemists; not in France, where it appears to have been unknown, but on the rest of the continent. The discovery of an alkaline base formed from carbon, hydrogen, oxygen, and azot, in which the neutralizing properties are very satisfactory, appears to us of the highest importance, and for this reason we are anxious to communicate the fact to our readers. We have repeated several of the author's experiments on morphium, and have found them accurate; but we confess that the part of his memoir which relates to meconic acid leaves much to be desired. Mr. Robiquet, whose talents are well known, has undertaken these researches, which we trust will throw much light on the subject. We are not afraid to declare, that the discovery of morphium will open a new field, and that we shall soon acquire precise notions with respect to poisons drawn from vegetables or animals. The greater part of those substances are remarkable, by their azotic nature, as well as by their alkaline properties; and they will form hereafter a genus, whose species will be found in very different vegetables. Already the celebrated Vauquelin, in the analysis of *Daphne alpina*, in which he found a substance which appears to have an analogy with morphium, has made a reflection, which ought to appear in this place:

" It is, that in general it seems, that acrid and caustic vegetable substances are oily or resinous; and, what is not less remarkable, that plants which conceal acrid and poisonous principles contain no free acid, or scarcely any; that, consequently, we ought to mistrust such plants that are not acid; and, on the contrary, such as contain a free acid should not inspire the same apprehensions." Bulletin de Pharmacie, iv. 538.

*Abstract of a Memoir entitled an Examination of some minerals found in the neighbourhood of Fahlun, and of their situation.* By J. G. Gahn, J. Berzelius, C. Wallman, and H. P. Eggertz. Inserted in the fifth Volume of the Afhandlingar i Fysik, Kemi och Mineralogi.*

(From the Annals of Philosophy, for June 1817.)

THE neighbourhood of Fahlun being remarkable for the great variety of uncommon minerals which have been found in it, Messrs. Gahn, Berzelius, Wallman, and Eggertz, undertook to examine them, both in a mineralogical and geognostic point of view; and in the excursions which they made last summer for that purpose their attention was fixed chiefly on the excavations at Finbo.

While analyzing the deuto-fluate of cerium, and the double fluate of cerium and yttria, Berzelius found in them *a new earth*, which he had extracted the preceding year from the gadolinite of Korarvet, but in too small quantity to be able at that time to determine its properties with the requisite precision. I shall extract from the memoir in question every thing that concerns the new earth.

### *Minerals in which the new Earth is found.*

The neutral *deuto-fluate of cerium* of Finbo is of a deeper red than that of Broddbo. It is sometimes found crystallized in six-sided prisms, the length of which exceeds the breadth, sometimes

* This volume has not yet been published. For the present abstract I am indebted to the Chevalier d'Ohsson, who kindly translated it from the Swedish original, of which he was possessed of a copy.—T.

in plates more or less thin, and sometimes in irregular amorphous masses. It is imbedded in a rock composed of albite, quartz, and mica, and is accompanied by emeralds and yttro-tantalite; but it occurs so sparingly, that all the specimens which we found were hardly sufficient for a single analysis. I satisfied myself, therefore, with ascertaining by small experiments that it is a neutral fluate of cerium; and by means of the blow-pipe I have satisfied myself that its deeper colour is owing to the presence of a greater proportion of manganese.

The rarest variety is that which is amorphous, and presents no marks of crystallization. Some of the experiments made upon it deserve to be stated here, though they cannot be considered as exhibiting an exact analysis.

A. Forty-eight parts of it being reduced to an impalpable powder, and calcined in a red heat, were submitted to the action of concentrated sulphuric acid, which occasioned the separation of the fluoric acid gas, and converted the mass into a semiliquid substance of a fine deep brown colour. After two hours digestion it was brought in contact with a little water, which occasioned a slight muddiness. The yellow liquid was decanted off, and mixed with hot water, which occasioned still greater opacity. The precipitate, being collected on the same filter as the undissolved portion, and being washed and heated to redness, weighed 9.6 parts.

B. The liquid was mixed with sulphate of potash till the whole of the cerium separated. When properly washed and dried, the oxide of cerium obtained weighed 26.3 parts.

C. The solution was then treated with ammonia. The resulting precipitate weighed, after calcination, 1.525 parts; and I found by an examination which I conceive it to be unnecessary to state separately, a mixture of yttria, alumina, oxide of manganese, and silica.

D. The 9.6 parts that had not been dissolved by sulphuric acid were digested at the temperature of boiling water in muriatic acid, which dissolved them with the exception of 2.5 parts, which were silica mixed with a trace of proto-fluate of cerium.

E. The muriatic solution was mixed with caustic ammonia. The

precipitate, being thrown upon a filter, was well washed, and dissolved while still moist in nitric acid; and this solution was left to evaporate spontaneously in a warm place. It produced a gummy mass, deliquescing in the air, which, being dissolved in a greater quantity of water, and boiled, let fall a white gelatinous precipitate, which was collected on the filter. It weighed three parts. Caustic ammonia, being mixed with the remaining solution, precipitated oxide of cerium, which still contained a portion of the earth precipitated by boiling. I shall describe below the experiments made on this earth.

The analysis, then, had assigned oxide of cerium as the principal substance, and had given the total quantity of 37.4 of solid matter. The loss, amounting to 10.6, greatly exceeds the quantity of fluoric acid which was requisite to saturate the different bases. This excess of loss is no doubt owing to the fluoric acid having carried off with it a portion of silica, which in all probability was only mechanically mixed, as it is in the minerals which I shall mention immediately.

*Double Fluate of Cerium and Yttria.*—There is an earthy mineral found at Finbo, which is much more common than the neutral fluates and subfluates of cerium; but its size seldom exceeds that of a pea. Its most usual colour is pale red, similar to that of a mixture of carmine and white lead; but it is sometimes white, or deep red, or nearly yellow. It is so soft that it may be easily scratched by the nail, and it may be easily detached from its matrix by the fingers. It then leaves a rough irregular cavity.

This mineral occurs likewise in irregular amorphous masses of a reddish-brown colour, sometimes separate, sometimes surrounding gadolinite, or mixed with it so as to appear a part of it. It never shows any tendency to assume a regular figure, or a crystalline texture.

I have made several analyses of this mineral, which have all given different results; which shows that the relative quantities of its constituent parts are very variable.

While analyzing a specimen of this mineral, which did not differ in its external appearance from other specimens, I found a new quantity of the same earth which had been extracted from

the amorphous neutral deuto-fluate of cerium. I shall state briefly this experiment.

Twenty-two parts of the pulverized mineral were treated with sulphuric acid, which decomposed it, with the exception of 3.5 parts. The solution was mixed with sulphate of potash to separate the oxide of cerium. It weighed two parts. I then added caustic ammonia. The precipitate which fell, being heated to redness, weighed 15.5 parts. I poured muriatic acid on it, which readily dissolved a portion of it. The residue was only dissolved by means of a long digestion. The liquid was evaporated to dryness by means of a gentle heat, in order to drive off the excess of acid. I then poured water over it, which dissolved the muriate of yttria. The residue was dissolved in muriatic acid, and the liquid was saturated by caustic ammonia as accurately as possible. I then added water, and caused it to boil. A white gelatinous precipitate fell, which was collected on the filter. The liquor that passed through the filter was again saturated by caustic ammonia, and heated to ebullition, which occasioned the precipitation of a new portion of the same earth. When washed and slightly dried, it weighed seven parts. In the 3.5 parts of yttria separated from the 15.5 parts I found, by means of caustic potash, a small quantity of alumina; the weight of which, however, I did not exactly determine.

### *Particular Examination of the new Earth.*

While I was examining the composition of gadolinite during the summer of 1815, I obtained in one of my analyses a peculiar substance, amounting to 30 per cent. of the weight of the mineral, and which possessed properties different from the other earths. It was absolutely similar to the substance just found at Finbo. It was separated from gadolinite in the following manner:—The mineral having been dissolved in nitro-muriatic acid, the filtered solution was saturated by caustic ammonia, and precipitated by succinate of ammonia, having a slight excess of acid. The liquor being filtered, I mixed it with sulphate of potash, which occasioned a precipitate. Before separating the yttria, I wished to prevent the oxide of manganese from being deposited along with it. For this purpose I fil-

tered into the liquid a boiling solution of muriate of ammonia, in order to form a double salt composed of muriate of ammonia and proto-muriate of manganese, which would prevent this last oxide from being precipitated by the ammonia. The consequence was a bulky white deposite. I continued to pour in the salt till all precipitation was at an end. The precipitate was thrown upon a filter, washed, and dried. Perceiving that it was a substance different from any which I expected to find in gadolinite, I wished to prepare a greater quantity of it. But though I endeavoured with the greatest care to ascertain all the external differences which the specimens of gadolinite from Korarvet exhibited, and examined each of them separately, I could not obtain the smallest trace of the substance, though I had fallen upon pretty correct methods of separating it from yttria and oxide of cerium, even when it existed only in small proportions. I therefore deferred to a future opportunity further researches on this substance, without even mentioning it in the analysis of that variety of gadolinite, because I still considered its existence as problematic. Having found it again at Finbo, I endeavoured to determine its properties more exactly; but as it happens here also that the same mineral does not always contain it, or that minerals which contain it are absolutely similar to those which do not contain it, I could not be sure at present of obtaining a new portion of it, without destroying a great part of the specimens of a mineral which is very rare. I have thought it right, therefore, in the present uncertainty, to describe it such as I have found it, that if it be discovered hereafter in greater abundance, as it is probable it will, my statements may facilitate the means of separating and examining it. I may state here, by way of apology for the imperfection of this notice, that I have not had altogether half a gramme of this earth to make my experiments with.

To obtain it from those minerals that contain protoxide of cerium and yttria, we must first separate the oxide of iron by succinate of ammonia. The new earth, indeed, may, when alone, be precipitated by the succinates; but in the analytical experiments in which I have obtained it, it precipitated in so small a quantity along with iron, that I could not separate it from that oxide. The deutoxide of cerium is then precipitated by the sulphate of potash; after which

the yttria and the new earth are precipitated together by caustic ammonia. Dissolve them in muriatic acid. Evaporate the solution to dryness, and pour boiling water on the residue, which will dissolve the greatest part of the yttria; but the undissolved residue still contains a portion of it. Dissolve it in muriatic or nitric acid, and evaporate it till it becomes as exactly neutral as possible. Then pour water upon it, and boil it for an instant. The new earth is precipitated, and the liquid contains disengaged acid. By saturating this liquid, and boiling it a second time, we obtain a new precipitate of the new earth.

This earth, when separated by the filter, has the appearance of a gelatinous, semitransparent mass. When washed and dried, it becomes white, absorbs carbonic acid, and dissolves with effervescence in acids. Though calcined, it retains its white colour; and when the heat to which it has been exposed was only moderate, it dissolves readily in muriatic acid; but if the heat has been violent, it will not dissolve till it be digested in strong muriatic acid. This solution has a yellowish colour; but it becomes colourless when diluted with water, as is the case with glucina, yttria, and alumina. If it be mixed with yttria, it dissolves more readily after having been exposed to heat. The neutral solutions of this earth have a purely astringent taste, which is neither sweet, nor saline, nor bitter, nor metallic. In this property it differs from all other species of earths except zirconia.

When dissolved in *sulphuric acid* with a slight excess of acid, and subjected to evaporation, it yields transparent crystals, which are not altered by exposure to the air, and which have a strong styptic taste.

The mother water remaining after the formation of these crystals retains but very little of the earth. When the crystals are exposed to the action of water, they are entirely decomposed. The solution becomes muddy, a subsulphate precipitates, and a supersulphate remains in solution. When this solution is boiled, it lets fall no precipitate. If the crystals of the sulphate of the new earth are exposed to the action of water in a state of rest, the subsulphate which remains undissolved retains the form of the crystals; but upon the least movement they fall to powder. The acid solution,

when mixed with sulphate of potash till saturation, does not let fall any precipitate; neither does any precipitate appear when sulphate of potash is dropped into the muriate of this earth. If the liquid be raised to the boiling temperature, a portion of the earth precipitates in the state of subsulphate, and a portion remains in the liquid, which may be precipitated by means of caustic ammonia.

This earth dissolves very easily in nitric acid; but, after being heated to redness, it does not dissolve in it except by long boiling. The solution does not crystallize, but forms a mucilaginous mass, which becomes more liquid by exposure to the air, and which, when evaporated by a moderate heat, leaves a white, opake mass, similar to enamel, in a great measure insoluble in water. When the neutral solution of this nitrate in water is boiled, a great portion of the earth is precipitated. If the solution contain an excess of acid, it allows a portion of the earth to precipitate when it is diluted with water and boiled. A slight calcination of the nitrate leaves the earth with its white colour, so that we discover no evidence of a higher degree of oxidizement.

It dissolves in muriatic acid, in the same manner as in nitric acid. The solution does not crystallize. When evaporated by a moderate heat, it is converted into a syrupy mass, which does not deliquesce in the air, but dries, becomes white like enamel, and afterwards dissolves only in very small quantity in water, leaving a subsalt undissolved; so that by spontaneous evaporation it lets the portion of muriatic acid escape to which it owed its solubility. A solution of this muriate, not too acid, and diluted with water, when raised to the boiling temperature, lets fall the greatest portion of the earth in the form of a gelatinous mass, light, and semitransparent. A solution of this earth in muriatic or nitric acid, when evaporated by a strong heat, leaves on the edges of the vessel a white, opake film, having the appearance of enamel. It appears very distinctly when the liquid is made to pass over the inside of the glass. This is a very characteristic mark of this earth; and I am not aware that it belongs to any other substance, except to the solution of phosphate of iron in nitric acid, which however does not present the phenomenon in so eminent a degree. I have been able from this layer of enamel to determine very well beforehand whether the mineral

which I was analyzing contained this earth or not. This mark, however, is less evident when the earth is mixed with a considerable quantity of yttria and protoxide of cerium.

This earth combines with avidity with carbonic acid. The precipitates produced by caustic ammonia, or by boiling the neutral solutions of the earth in acids, absorb carbonic acid from the air in drying. The alkaline carbonates precipitate the earth combined with the whole of their carbonic acid.

The *oxalate of ammonia* throws down a white, voluminous precipitate, insoluble in water as well as in caustic alkalies.

The *tartrate of ammonia* produces a white precipitate, which redissolves at first, and does not become permanent till a sufficient quantity of the salt has been added. This precipitate is redissolved by caustic ammonia. Boiling drives off the ammonia; but the earth is not deposited till the liquid has been concentrated to a certain degree by evaporation. It then precipitates under the form of a gelatinous mass, almost transparent.

The *citrate of ammonia* does not occasion any precipitate, not even when caustic ammonia is added to it; but if the liquid be boiled, the earth precipitates in proportion as the ammonia evaporates. This precipitate is analogous to those that are produced by boiling in the other neutral solutions of this earth.

The *benzoate of ammonia* produces a white, bulky precipitate.

The *succinate of ammonia* occasions a precipitate, which is immediately redissolved. If a sufficient quantity be added to prevent the precipitate from redissolving, and if we attempt to redissolve it by pouring in water, it is decomposed, and remains in a great measure undissolved, under the form of a salt with excess of base, while the liquid contains the greatest part of the acid united to a small portion of the earth.

The *ferruginous prussiate of potash* poured into a solution of this earth, throws down a white precipitate, which is completely redissolved by muriatic acid.

Caustic potash and ammonia have no action on this earth newly precipitated, not even at a boiling temperature.

The solution of carbonate of potash or carbonate of ammonia dissolves a small quantity of it, which precipitates again when the

liquid is supersaturated with an acid, and then neutralized by caustic ammonia; but this earth is much less soluble in the alkaline carbonates than any of the earths formerly known that dissolve in them.

A portion of this earth weighing 12 parts was exposed in a charcoal crucible to the heat employed to reduce tantalum, and the fire was kept up for an hour. When withdrawn, it did not appear to have undergone any other alteration than to have contracted in its dimensions, and to have acquired a slight transparency, having probably been near the fusing point. It exhibited no appearance of reduction, and was dissolved by boiling in muriatic acid. As it is at present generally known that the salifiable bases are metallic oxides, it may appear indifferent whether we say *earth* or *metallic oxide*. But these substances being divided into alkalies, earths, and metallic oxides, the proper method seems to be to attach every new link of the chain of oxides to those with which it has the greatest analogy. And since the earths are distinguished chiefly by being colourless, and by being irreducible when heated with charcoal without the assistance of a foreign metal, I consider the substance which has been just described as belonging particularly to the class of earths.

Although the experiments of which I have just given an account cannot certainly be considered as more than preparatory to a more complete examination of this earth, when a greater quantity of it is found, I have thought that it would be convenient to give it a name, that it might be pointed out more easily. A part of these experiments having been made in the laboratory of Mr. Gahn, at Fahlun, we were accustomed to speak of it to each other under the appellation *thorina*, from *Thor*, an ancient Scandinavian deity. It may, therefore, not be unsuitable to distinguish it provisionally by this denomination.

Thorina does not fuse before the blow-pipe. With borax it melts into a transparent glass, which, when exposed to the exterior flame, becomes opake and milky. With phosphate of soda it fuses into a transparent pearl. It is infusible with soda. When soaked with a solution of cobalt, it becomes greyish-brown.

Thorina differs from the other earths by the following properties:

From *alumina*, by its insolubility in hydrate of potash; from *glucina*, by the same property; from *yttria*, by its purely astringent taste without any sweetness, and by the property which its solutions possess of being precipitated by boiling when they do not contain too great an excess of acid. It differs from zirconia by the following properties: 1. After being heated to redness, it is still capable of being dissolved in acids. 2. Sulphate of potash does not precipitate it from its solutions, while it precipitates zirconia from solutions containing even a considerable excess of acid. 3. It is precipitated by oxalate of ammonia, which is not the case with zirconia. 4. Sulphate of thorina crystallizes readily, while sulphate of zirconia, supposing it free from alkali, forms, when dried, a gelatinous, transparent mass, without any trace of crystallization.

As thorina has a greater analogy with zirconia than with any other body, and as the two earths occur together at Finbo, it may be useful perhaps to exhibit here a parallel between their properties:—

| Thorina. | Zirconia. |
|---|---|
| Taste of the neutral solutions purely astringent. | The same. |
| Crystallizes easily with sulphuric acid. The crystals are decomposed by water. | Does not crystallize, but becomes mucilaginous; and when long exposed to a moderate heat becomes white, opake, saline. Deliquesces in the air; but becomes muddy when water is poured into it, unless the solution be very acid. The dried salt can bear a moderate heat, without being more than partially decomposed. |
| The muriatic solution gives a precipitate when boiled. This precipitate is bulky, semitransparent, and gelatinous. Muriate of thorina does not crystallize. | The muriatic solution is precipitated by boiling. The precipitate is a heavy, white, opake powder. Muriate of zirconia crystallizes by evaporation. |
| The nitric solution, when boiled, lets fall a gelatinous earth. | The same. |
| Alkaline *succinates*, *benzoates*, and *tartrates*, occasion a preci- | The same. |

| Thorina. | Zirconia. |
| --- | --- |
| pitate in the solution of thorina. The precipitate by an alkaline tartrate is dissolved by hydrate of potash. | |
| The *citrates* occasion no precipitate; but a precipitate appears when the liquid is boiled. | The *citrates* occasion no precipitate, nor does one appear when the liquid is boiled. |
| *Oxalate* of ammonia precipitates thorina from its solution in sulphuric acid. | *Oxalate* of ammonia throws down no precipitate from sulphate of zirconia. |
| Sulphate or muriate of thorina dissolved in water, and mixed to saturation with sulphate of potash, lets falls no precipitate. | A salt of zirconia dissolved in water, and mixed to saturation with sulphate of potash, is entirely precipitated. If this is done in the cold, the precipitate is entirely soluble in water. |
| Insoluble in hydrate of potash. | The same. |
| Soluble in alkaline carbonates. | The same, but in much greater quantity. |
| Becomes by calcination difficult of solution. | When heated to redness, becomes insoluble. |

These two earths exhibit the same properties before the blow-pipe.*

I have reason to presume that the thorina found in the mineral from Korarvet which I analyzed, was in the state of a *silicate*, similar to gadolinite; but that the portion found at Finbo was in a state of combination with fluoric acid.

* I have read somewhere that zirconia gives a blue colour with cobalt, and hoped that this would furnish a ready method of distinguishing the two earths: but the blue colour does not appear except when the zirconia contains an alkali. When pure zirconia is obtained by expelling the acid from sulphate of zirconia by heat, it does not enter into fusion nor become blue with cobalt, but greyish-brown.

## *An Essay on the Oopas, or Poison Tree of Java, addressed to the Honourable Thomas Stamford Raffles, Lieutenant Governor. By Thomas Horsfield, M. D. (Communicated to the Society by the President.)**

(From the Annals of Philosophy, March 1817.)

I HAVE proposed to myself in the following Essay to offer you a short account of the oopas of Java. I feel some satisfaction in being able, at a time when every subject relating to this island has acquired a degree of interest, to furnish you with a faithful description of the tree, made by myself on the spot where it grows, and to relate its effects on the animal system by experiments personally instituted and superintended; and I flatter myself, that the practical information detailed in the following sheets will refute the falsehoods that have been published concerning this subject, at the same time that it will remove the uncertainty in which it has been enveloped.

The literary and scientific world has in few instances been more grossly and impudently imposed upon than by the account of the pohon oopas, published in Holland about the year 1780. The history and origin of this celebrated forgery still remains a mystery. Foersch, who put his name to the publication, certainly was (according to information I have received from creditable persons who have long resided on the island,) a surgeon in the Dutch East India Company's service, about the time the account of the oopas appeared.† It would be in some degree interesting to become acquainted with his character. I have been led to suppose that his literary abilities were as mean as his contempt of truth was consummate.

Having hastily picked up some vague information concerning the

* From the Batavian Transactions, vol. vii. Published at Batavia in 1814.

† Foersch was a surgeon of the third class at Samarang, in the year 1773. His account of the oopas tree appeared in 1783.

oopas, he carried it to Europe, where his notes were arranged, doubtless by a different hand, in such a form, as by their plausibility and appearance of truth, to be generally credited.

It is in no small degree surprising that so palpable a falsehood should have been asserted with so much boldness, and have remained so long without refutation; or that a subject of a nature so curious and so easily investigated, relating to its principal colony, should not have been enquired into and corrected by the naturalists of the mother country.

To a person in any degree acquainted with the geography of the island, with the manners of the princes of Java, and their relation to the Dutch government at that period, or with its internal history during the last 50 years, the first glance at the account of Foersch must have evinced its falsity and misrepresentation. Long after it had been promulgated, and published in the different public journals in most of the languages of Europe, a statement of facts, amounting to a refutation of this account, was published in one of the volumes of the Transactions of the Batavian Society, or in one of its prefatory addresses. But not having the work at hand, I cannot with certainty refer to it, nor shall I enter into a regular examination and refutation of the publication of Foersch, which is too contemptible to merit such attention.

But though the account just mentioned, in so far as relates to the situation of the poison tree, to its effects on the surrounding country, and to the application said to have been made of the oopas on criminals in different parts of the island, as well as the description of the poisonous substance itself, and its mode of collection, has been demonstrated to be an extravagant forgery; the existence of a tree on Java, from whose sap a poison is prepared, equal in fatality, when thrown into the circulation, to the strongest animal poisons hitherto known, is a fact, which is at present my object to establish and to illustrate.

The tree which produces this poison is called *antshar*, and grows in the eastern extremity of the island. Before I proceed to the description of it, and of the effects produced by this poison, I must premise a few remarks on the history of its more accurate

investigation, and on the circumstances which have lately contributed to bring a faithful account of this subject before the public.

At the time I was prosecuting my enquiries into the botany and natural history of the island on behalf of the Dutch government, Mr. Leschenault de la Tour, a French naturalist, was making a private collection of objects of natural history for the governor of the north-east coast of Java. He shortly preceded me in my visit to the eastern districts of the island, and while I was on my route from Sourabaya in that direction, I received from him a communication containing an account of the poison tree, as he found it in the province of Blambangan. I am induced to make this statement, in order to concede, as far as regards myself, to Mr. Leschenault de la Tour, in the fullest manner, the priority in observing the oopas of Java. I do this to prevent any reflection, in case a claim to the discovery should be made at a future period: but I must be permitted to add, in justice to the series of enquiries which engaged me, and the manner in which they were carried on, that the knowledge of the existence of this tree was by no means uncommon or secret in the district of Blambangan, in the environs of Banyoo-wangee; that the commandant of the place, a man of some curiosity and enquiry, was acquainted with it, and that it could not (in all probability) have escaped the notice of a person, who made the vegetable productions an object of particular enquiry, and noted with minute attention every thing that related to their history and operation.

It is in fact more surprising that a subject of so much notoriety in the district of Blambangan, and of so great celebrity and misrepresentation in every other part of the world, should so long have remained unexplored, than that it should finally have been noticed and described; and since my visit to that province I have more than once remarked the coincidence which led two persons of nations different from each other, and from that which has long been in possession of the island, who commenced their enquiries without any previous communication, and with different objects in view, within the period of about six months, to visit and examine the oopas tree of Java.

The work of Rumphius contains a long account of the oopas,

under the denomination of arbor toxicaria; the tree does not grow on Amboina, and his description was made from the information he obtained from Macassar.

His figure was drawn from a branch of that which was called the male tree, sent to him from the same place, and established the identity of the poison tree of Macassar and the other eastern islands with the antshar of Java.

The account of this author is too extensive to be abridged in this place, it concentrates all that has till lately been published on this subject: but the relation is mixed with many assertions and remarks of a fabulous nature, and it is highly probable that it was consulted in the fabrication of Foersch's story. It is, however, highly interesting, as it gives an account of the effects of the poisoned darts, formerly employed in the wars of the eastern islands, on the human system, and of the remedies by which their effect was counteracted and cured.

The simple sap of the arbor toxicaria (according to Rumphius) is harmless, and requires the addition of ginger and several substances analogous to it, such as ledoory and lampoegang, to render it active and mortal. In so far it agrees with the antshar, which, in its simple state, is supposed to be inert, and before being used as a poison is subjected to a preparation which will be described after the history of the tree. The same effervescence and boiling, which occurs on the mixture of the substances added to the milky juice by the Javanese in Blambangan, has been observed in the preparation of the poison of Macassar, and in proportion to the violence of these effects the poison is supposed to be active.

A dissertation has been published by Chrisp. Aejmlaeus at Upsal, which contains the substance of the account of Rumphius; an extract from it is given in Dr. Duncan's Medic. Comment. for the year 1790, vol. ii. decad. v.

It appears from the account of Rumphius that this tree is also found on Borneo, Sumatra, and Bali.

Besides the true poison tree, the oopas of the eastern islands and the antshar of the Javanese, this island produces a shrub, which, as far as observations have hitherto been made, is peculiar to the same, and by a different mode of preparation, furnishes a poison

far exceeding the oopas in violence. Its name is *tshettik*, and its specific description will succeed to that of the antshar. The genus has not yet been discovered or described.

*Description of the Antshar.*—The *antshar* belongs to the twenty-first class of Linnæus, the monoecia. The male and female flowers are produced in catkins, (amenta) on the same branch, at no great distance from each other; the female flowers are in general above the male.

The characters of the genus are:

*Male Flower.*—*Calix*, consisting of several scales which are imbricate; *corol*, none; *stamens*, filaments many, very short, covered by the scales of the receptacle-anthers.

The receptacle on which the filaments are placed has a conical form, abrupt, somewhat rounded above.

*Female Flower.*—Catkins ovate; *calix* consisting of a number of imbricate scales (generally more than in the male) containing one flower; *corol*, none; *pistil*, germ single, ovate erect; *styles*, two, long, slender, spreading; *stigmas*, simple acute; *seed-vessel*, an oblong drupe, covered with the calix; *seed*, an ovate nut, with one cell.

*Specific description.*—The antshar is one of the largest trees in the forest of Java.—The stem is cylindrical, perpendicular, and rises completely naked to the height of 60, 70, or 80 feet. Near the surface of the ground it spreads obliquely, dividing into numerous broad appendages or wings, much like the *canarium commune*, and several others of our large forest trees It is covered with a whitish bark, slightly bursting in longitudinal furrows: near the ground this bark is, in old trees, more than half an inch thick, and, upon being wounded, yields plentifully the milky juice from which the celebrated poison is prepared. A puncture or incision being made in the tree, the juice or sap appears oozing out, of a yellowish colour, (somewhat frothy,) from old trees paler, and nearly white from young ones: when exposed to the air, its surface becomes brown. The consistence very much resembles milk, only it is thicker, and viscid. This sap is contained in the true bark (or cortex) which, when punctured, yields a considerable quantity, so that in a short time a cupful may be collected from a large tree.

The inner bark (or liber) is of a close fibrous texture, like that of the *morus papyrifera*, and when separated from the other bark, and cleansed from the adhering particles, resembles a coarse piece of linen. It has been worked into ropes, which are very strong, and the poorer class of people employ the inner bark of younger trees, which is more easily prepared, for the purpose of making coarse stuff which they wear when working in the fields. But it requires much bruising, washing, and a long immersion in water before it can be used; and even when it appears completely purified, persons wearing this dress, on being exposed to the rain, are affected with an intolerable itching, which renders their flimsy covering almost insupportable.

It will appear, from the account of the manner in which the poison is prepared, that the deleterious quality exists in the gum, a small portion of which still adhering to the bark, produces, when it becomes wet, this irritating effect; and it is singular, that this property of the prepared bark is known to the Javanese in all places where the tree grows, (for instance, in various parts of the provinces of Bangil and Malang, and even at Onarang) while the preparation of a poison from its juice, which produces a mortal effect when introduced into the body by pointed weapons, is an exclusive art of the inhabitants of the eastern extremity of the island.

One of the Regents in the eastern districts informed me, that having many years ago prepared caps or bonnets from the inner bark of the antshar, which were stiffened in the usual manner with thick rice water, and handsomely painted, for the purpose of decorating his mantries, they all decidedly refused to wear them, asserting that it would cause their hair to fall out.

The stem of the antshar having arrived at the before-mentioned height, sends off a few stout branches, which, spreading nearly horizontally with several irregular curves, divide into smaller branches, and form a hemispherical, but not very regular crown. The external branches are short, have several unequal bends, and are covered with a brown bark.

The leaves are alternate, oblong, heart-shaped, somewhat narrower towards the base, entire, with a waving or undulated margin, which sometimes has a few irregular sinuosities. The longitudinal

nerve divides the leaf somewhat obliquely, and the inferior division is generally the larger. The point is irregular; some are rounded at the end, others run off almost abruptly to a short point. The upper surface is shining and nearly smooth; some widely dispersed short villi are observed on it; the inferior surface is slightly rough, reticulated, and marked with oblique-parallel veins. The petiole is short. The flowers are produced towards the extremity of the outer branches, in a few scattered catkins; the common peduncle of the males is slender and long; that of the females is shorter.

Previous to the season of flowering, about the beginning of June, the tree sheds its leaves, which re-appear when the male flowers have completed the office of fecundation. It delights in a fertile and not very elevated soil, and is only found in the largest forests. I first met with it (the antshar) in the province of Poegar, on my way to Banjoowangee; in the province of Blambangan I visited four or five different trees, from which this description has been made, while two of them furnished the juice for the preparation of the oopas. The largest of these trees had, where the oblique appendages of the stem entered the ground, a diameter of at least ten feet; and where the regularly round and straight stem began, the extent of at least ten feet between the points of two opposite appendages at the surface of the ground, its diameter was full three feet. I have since found a very tall tree in Passooroowang, near the boundary of Malang, and very lately I have discovered several young trees in the forests of Japara, and one tree in the vicinity of Onarang. In all these places, though the inhabitants are unacquainted with the preparation and effect of the poison, they distinguish the tree by the name of Antshar. From the tree I found in the province of Passooroowang I collected some juice, which was nearly equal in its operation to that of Blambangan. One of the experiments to be related below was made with the oopas prepared by myself, after my return to the chief village. I had some difficulty in inducing the inhabitants to assist me in collecting the juice, as they feared a cutaneous eruption and inflammation, resembling, according to the account they gave of it, that produced by the ingas of this island, the *rhus vernix* of Japan, and the *rhus radicans* of North America: but they

were only affected by a slight heat and itching of the eyes. In clearing the new grounds in the environs of Banjoowangie for cultivation, it is with much difficulty the inhabitants can be made to approach the tree, as they dread the cutaneous eruption which it is known to produce when newly cut down. But except when the tree is largely wounded, or when it is felled, by which a large portion of the juice is disengaged, the effluvia of which mixing with the atmosphere, affect the persons exposed to it with the symptoms just mentioned, the tree may be approached and ascended like the other common trees in the forests.

The antshar, like the trees in its neighbourhood, is on all sides surrounded by shrubs and plants; in no instance have I observed the ground naked or barren in its immediate circumference.

The largest tree I met with in Blambangan was so closely environed by the common trees and shrubs of the forest in which it grew, that it was with difficulty I could approach it. Several vines and climbing shrubs, in complete health and vigour, adhered to it, and ascended to nearly half its height. And at the time I visited the tree and collected the juice, I was forcibly struck with the egregious misrepresentation of Foersch. Several young trees spontaneously sprung from seeds that had fallen from the parent, reminded me of a line in Darwin's Botanic Garden:—

"Chained at his root two scion Demons dwell."

While in recalling his beautiful description of the oopas, my vicinity to the tree gave me reason to rejoice that it is founded on fiction. The wood of the antshar is white, *light, and of a spongy appearance.*

*Description of the Tshittik.*—The fructification of the tshittik is still unknown; after all possible research in the district where it grows, I have not been able to find it in a flowering state.—It is a large winding shrub.

The root extends creeping to a considerable distance, parallel to the surface of the earth, sending off small fibres at different curves, while the main root strikes perpendicularly into the ground.

In large individuals it has a diameter of two or three inches; it is covered with a reddish-brown bark, containing a juice of the

same colour, of a peculiar pungent, and somewhat nauseous odour. From this bark the poison is prepared.

The stem, which in general is shrubby, sometimes acquires the size of a small tree; it is very irregular in its ascent and distribution: having made several large bends near the surface of the earth, it divides (at long intervals) into numerous branches, which attach themselves to the neighbouring objects, and pursue a winding course at no great distance from the ground, and nearly parallel to it. In some instances the stem rises and ascends to the top of large trees; its form is completely cylindrical, and it is covered with a grey spotted bark.

The lesser branches arise from the stem in pairs (opposite) and are very long, slender, cylindrical, divergent, or spreading, and covered with a smooth grey shining bark; on these the leaves are placed opposite, in single pairs, or on a common footstalk, pinnate in two or three pairs; they are egged, spear-shaped, entire, terminating in a long narrow point, completely smooth, and shining on the upper surface, with a few parallel veins beneath.—The petioles are short and somewhat curved. Towards their extremity the shoots produce cirrhi or tendrils, which appear without any regular distribution opposite to the leaflets; and some branches are entirely without them: they are about an inch long, slender, compressed, and spirally turned back (recurvati:) at the end near their base a small stipula is found.

The tshittik grows only in close, shady, almost inaccessible forests, in a deep, black, fertile, vegetable mould. It is very rarely met with, even in the wildernesses of Blambang an.

1. *Preparation of the Antshar.*—This process was performed for me by an old Javanese, who was celebrated for his superior skill in preparing the poison. About eight ounces of the juice of the antshar, which had been collected the preceding evening in the usual manner, and preserved in the joint of a bamboo, was carefully strained into a bowl. The sap of the following substances, which had been finely grated and bruised, was carefully expressed and poured into it: viz. arum, *nampoo* (Javanese), kaemferia galanga, *kontshur*, amomum, *bengley*, (a variety of ze-

rumbed,) common *onion* and *garlic*, of each about half a dram; the same quantity of finely powdered black pepper was then added, and the mixture stirred.

The preparer now took an entire fruit of the *capsicum frutico-sum*, or Guinea pepper, and having opened it, he carefully separated a single seed, and placed it on the fluid in the middle of the bowl.

The seed immediately began to reel round rapidly, now forming a regular circle, then darting towards the margin of the cup, with a perceptible commotion on the surface of the liquor, which continued about one minute. Being completely at rest, the same quantity of pepper was again added, and another seed of the capsicum laid on as before: a similar commotion took place in the fluid, but in a less degree, and the seed was carried round with diminished rapidity. The addition of the same quantity of pepper was repeated a third time, when a seed of the capsicum, being carefully placed in the centre of the fluid, remained quiet, forming a regular circle about itself in the fluid, resembling the halo of the moon. This is considered as a sign that the preparation of the poison is complete.

The dried milk of the antshar, having been preserved close a considerable time, can still be prepared and rendered active. A quantity which I had collected about two months before, was treated in the following manner, by the same person who prepared the fresh juice. Being infused in as much hot water as was barely sufficient well to dissolve it, it was carefully stirred till all the particles soluble in water were taken up; a coagulum of resin remained undissolved; this was taken up and thrown away. The liquor was now treated with the spices above mentioned, the pepper, and the seed of the capsicum, in the same manner as the fresh juice. The same whirling motion occurred as above described, on the seed being placed in the centre. Its activity will appear from one of the experiments to be related.

2. *Of the Tshittik.*—The bark of the root is carefully separated, and cleared of all the adherent earth; a proportionate quantity of water is poured on, and it is boiled about an hour, when the fluid is carefully filtered through a white cloth. It is then exposed

to the fire again, and boiled down to nearly the consistence of an extract; in this state it much resembles a thick syrup. The following spices, having been prepared as above described, are added in the same proportion as to the antshar, viz. kaempferia galanga, (*kontshur*,) *soonty*, &c. *Dshey*, for common *onion*, *garlic*, and *black pepper*.

The expressed juice of these is poured into the vessel, which is once more exposed to the fire a few minutes, when the preparation is complete. The oopas of both kinds must be preserved in very close vessels.

*Experiments.*—I. *With the Antshar.*

*Exper.* 1.—A dog of middling size was wounded in the muscles of the thigh with an arrow that had been immersed into the newly prepared oopas, and had been exposed to the air one night. In three minutes he seemed uneasy, he trembled, and had occasional twitchings, his hair stood erect, he discharged the contents of his bowels. An attempt was made to oblige him to walk, but he could with difficulty support himself. In eight minutes he began to tremble violently; the twitching continued, and his breathing was hasty. In 12 minutes he extended his tongue and licked his jaws; he soon made an attempt to vomit. In 13 minutes he had violent contractions of the abdominal and pectoral muscles, followed by vomiting of a yellowish fluid. In 15 minutes the vomiting recurred. In 16 minutes, almost unable to support himself, with violent contraction of the abdominal muscles. In 17 minutes he threw himself on the ground, his respiration was laborious, and he vomited a frothy matter. In 19 minutes violent retching, with interrupted discharge of a frothy substance from his stomach. In 21 minutes he had spasms of the pectoral and abdominal muscles, his breathing was very laborious, and the frothy vomiting continued. In 24 minutes in apparent agony, turning and twisting himself, rising up and lying down, throwing up froth. In 25 minutes he fell down suddenly, screamed, extended his extremities convulsed, discharged his excrement, the froth falling from his mouth. On the 26th minute he died.

*Dissection.*—The abdomen being opened about five minutes after death, a small quantity of serous fluid was found in the cavity; the liver, intestines, and other viscera, were natural.—In the stomach a yellowish frothy mucilage was found adhering to the internal coat, which was contracted into wrinkles.

In the thorax the lungs were of an elegant florid colour, and gorged with blood, the pulmonary vessels exhibiting through their coats a florid sanguinary fluid: on puncturing the ascending aorta, the blood gushed out of a florid colour.

In the venæ cavæ the blood was of the usual dark hue, and on puncture flowed out forcibly. The muscles of the extremities were remarkably pale: on tracing the wound, it was found inflamed, and in two places along its course a small quantity of blood was found effused between the muscle and tendon.

*Exper.* 2.—A dog about four months old was pricked in the muscles of the thigh with the oopas that had been prepared from the juice I collected in Poegar; the poison had remained on the arrow about 48 hours. In three minutes he began to tremble, and the wounded limb shook more considerably; he soon began to droop, hung his head, and, extending his tongue, licked his jaws. In four minutes he began to retch; on the eighth minute he vomited, with violent and painful contraction of the pectoral and abdominal muscles, which agitated his whole frame. In nine minutes he vomited again with convulsive violence; the secretion of saliva was much increased, he stretched out his fore-legs as if he could with difficulty support himself, his head hanging to the ground; his breathing was slow and laborious. In 11 minutes he threw up frothy matter, with violent contraction of the abdominal and pectoral muscles, and throwing himself on the ground, cried out violently. In 12 minutes the vomiting returned, he cried more violently, was seized with convulsions, extended his extremities, and on the 13th minute he died.

On *dissection*, a small quantity of serum was found in the abdomen. The intestines were natural, the liver was much distended with blood, as also the vessels of the kidneys.

The stomach still contained some aliment.

In the thorax the lungs were of a beautiful crimson colour, and

the vessels strongly distended; on puncturing the aorta, the blood bounded out forcibly of an elegant florid colour; collected in a cup, it soon coagulated; from the venæ cavæ the blood also sprung out forcibly of a dark livid colour.

The vessels on the surface of the brain were more than naturally injected with blood; as were the longitudinal and frontal sinuses. The wound was as in the last instance.

*Exper.* 3.—An animal called gendoo by the Javanese (the lemur volans of Linnæus) was pricked in the cavity of the ear with a mixture of the simple unprepared fresh juice of antshar, with a little extract of tobacco. It felt the effects very soon, and during the first minutes it was very restless; on the fifth minute it became drooping. In 10 minutes it was convulsed, and soon became motionless and apparently insensible. On the 20th minute it died.

It must be remarked, that this animal is uncommonly tenacious of life.

In attempting to kill it, for the purpose of preparing and stuffing, it has more than once resisted a violent strangulation full 15 minutes.

*Exper.* 4.—A young lutra (welinsang of the Javanese) was punctured near the anus in the muscles of the abdomen, with the simple fresh juice of the antshar, mixed with a little extract of stramonium; very soon after the puncture the animal became restless, and holding it in my hand, I could perceive convulsive twitchings of the muscles. In 15 minutes it began to retch, had an increased flow of saliva, and extended the tongue: the abdominal muscles acted violently, and at intervals were strongly contracted about the pelvis. In 20 minutes it was convulsed, very restless during the intervals, and made repeated efforts to vomit, without throwing up any thing: the convulsions increased in frequency and violence until the 25th minute, when the animal died.

*Exper.* 5.—A small dog was wounded in the usual manner in the muscles of the thigh with the simple unprepared milk of the antshar. From the moment of the puncture he continued barking and screaming incessantly eight minutes; he now extended his tongue, licked his jaws, was seized with twitchings of the extremities, and with contractions of the abdominal muscles, and dis-

charged the contents of his bowels. On the 10th minute he sprung up suddenly and barked violently, but soon became exhausted, and laid down quietly on the ground. On the 12th minute he fell prostrate, was convulsed, after which, having remained apparently motionless one minute, the convulsions recurred with greater force. On the 14th minute he died.

On *dissection*, all the vessels in the thorax were found excessively distended with blood.

In the abdomen the stomach was almost empty, but distended with air, and its internal coat covered with froth. The vessels of the liver were gorged with blood.

*Exper.* 6.—A bird of the genus ardea, somewhat smaller than a fowl, was wounded in the muscles of the abdomen with a dart covered with the unprepared milk of the antshar. On the sixth minute after the puncture it died, without exhibiting much of the effects of the poison, having been held in the hand to prevent its escape.

*Exper.* 7.—A bird of the same genus (as employed in the last experiment) was wounded in the muscles of the inferior part of the wing, with the unprepared milk of the antshar, collected from a different tree in the province of Blambangan. In 15 minutes he threw up a yellow matter from his stomach and trembled. In 20 minutes he died, having previously been convulsed.

*Exper.* 8.—A mouse was punctured in the muscles of the foreleg, near the articulation, with the prepared poison. He immediately shewed symptoms of uneasiness, running round rapidly, and soon began to breathe hastily. In five minutes his breathing was laborious and difficult, and on the sixth minute, not being able to support himself, he lay down on his side. In eight minutes he was convulsed, and his breathing was slow and interrupted; the convulsions continued until the 10th minute, when he died.

*Exper.* 9.—This experiment was made with the sap of the antshar, which I collected near the village of Porrong in Passoorowang, and prepared according to the process I had seen at Banjoowangee, with the spices above mentioned. As its object is to shew the relative action of the poison collected in different parts of the island, (and as it generally agrees with the first and second

experiments,) I shall only mention its chief stages. In one minute after the puncture the animal began to shiver, and his skin was contracted. In five minutes he extended his tongue and began to retch. In eight minutes he trembled violently. On the 21st minute he vomited. In 24 minutes, after repeated vomiting, his extremities were convulsed. On the 29th minute he died.

The appearances on dissection were exactly the same as those observed in the first and second experiments.

*Exper.* 10.—The simple unprepared juice of the antshar from the same tree, (vide Experiment 9,) applied on a small dog in the usual manner, caused death on the 19th minute, with the symptoms that occurred in the other experiments.

*Exper.* 11.—A small monkey was wounded in the muscles of the thigh, with a dart covered with the prepared oopas from Banjoowangee. He was instantly affected by the poison, and in less than one minute lay prostrate on his side: on attempting to rise, he shewed symptoms of drowsiness, which continued five minutes, when he began to retch. On the sixth minute he vomited and discharged the contents of his rectum. He was soon seized with convulsions, and on the seventh minute he died. The same appearances were remarked on dissection as in the former experiments.

*Exper.* 12.—A cat was wounded with the same poison. In one minute the breathing became quick. In seven minutes the saliva flowed in drops from the tongue. In nine minutes she vomited a white frothy matter, and appeared in agony. On the 11th minute she threw up an excremental matter. In 14 minutes she discharged the contents of the bladder and rectum involuntarily. In 15 minutes she died convulsed.

*Exper.* 13.—The following experiment was made on the animal of the ox tribe, in common domestic use in Java, called korbow by the Javanese, and buffalo by the Europeans: the subject was full grown, and in perfect health and vigour. Having been well secured, he was wounded by a dart somewhat larger than those used in the other experiments, covered with the oopas from Blambangan, (applied about 24 hours before,) in the internal mus-

cles of the thigh, in an oblique manner, the skin having been previously divided to admit the weapon freely.

The animal being in some degree loosened, about one minute after the puncture the dart was extricated: I suppose that about six grains of the poison adhered to the wound. On the 10th minute the respiration was somewhat increased and heavy. In 20 minutes he had a copious discharge from his intestines, a watery fluid flowed from his nostrils, and he shewed some symptoms of drowsiness. In 30 minutes he had an increased flow of saliva, which dropped from his mouth, he extended his tongue and licked his jaws; his respiration became more laborious; his pectoral muscles acted with violence, and the abdominal muscles were strongly contracted above the pelvis. His motions were slow and difficult. His muscular exertions were much diminished, and he exhibited great fatigue accompanied by restlessness: all these symptoms gradually increased until the 60th minute. His hair stood erect: unable to support himself, he lay down: he had contractions of the extremities: the abdominal and pectoral muscles were more violently convulsed, and the respiration was more laborious. The restlessness rapidly increased; having risen with difficulty, he quickly lay down again exhausted and panting; the flow of saliva from his mouth continuing. In 75 minutes he extended his tongue, and made an attempt to vomit; his extremities trembled; he rose and threw himself down again suddenly, extending his head. On the 80th minute the saliva flowed in streams from his mouth mixed with froth: he retched violently, with excessive convulsive action of his pectoral muscles, but unable to vomit, he appeared in great agony. In 90 minutes he extended his head with strong convulsions, and trembled; the hair stood erect; he discharged the contents of his bowels; the breathing became more laborious, and the muscles of the abdomen and breast acted with excessive violence. The agony increasing, he rose a few seconds, but, unable to support himself, fell down again. The 110th minute, having made an attempt to rise, he fell down head foremost, with convulsions of the extremities and head; he groaned violently, the respiration was much impeded, and recurred at intervals of 15 seconds. On the 120th minute he lay in great agony, groaned, bel-

lowed, and extended his tongue and extremities violently convulsed. In 125 minutes he was entirely exhausted: the breathing returned after long intervals. On the 130th minute he died convulsed.

Fifteen minutes after the motions of life had ceased, I opened the cavities of the abdomen and breast. The stomach was immensely distended with air: the vessels of all the viscera of the abdomen were as injected and distended with blood. In the thorax the lungs were of a vivid, florid, crimson colour, and the great vessels (the aorta, venæ cavæ, and the arteries and veins of the lungs) were gorged with blood.

A small puncture being made in the aorta, the blood bounded out in a stream of a beautiful crimson colour; from the venæ cavæ it flowed of a dark livid colour. In the large muscles of the pectus, which had been divided in the dissection, a trembling vibratory motion was observed full 20 minutes after the motions of life had ceased.

*Exper.* 14.—A fowl of middling size was punctured in the muscles of the thigh with a poisoned dart from Banjoowangee. During the first hour it was little affected by the wound. In about two hours it appeared drowsy, and had slight shivering. It continued drooping and quiet till 24 hours after the puncture, when it died.

(*To be continued.*)

## *On the internal and external use of the Nitro-muriatic Acid, in the cure of Diseases. By H. Scott, M. D. Read March 4, 1817, before the Medical and Chirurgical Society of London.*

I HAVE been assured by several members of this society, of which I have the honour to be an associate, that some account of the way in which I have long been in the habit of employing the nitro-muriatic acid, would be acceptable to this learned body. Such an account has become the more necessary, as many persons have begun to employ the remedy in question with little information as to its effects or its management. It is capable of producing more remarkable changes in the human body, and with less disturbance of its functions, than any other substance with which I am acquainted.

I had not long been in India, before I had reason to think that the oxides of mercury were of the utmost importance in the treatment of many diseases of that climate, such as chronic and acute hepatitis, dysentery, flux, asthma, and of some other complaints. I became convinced, for instance, that in obviating abscess of the liver, we can trust to nothing but the mercurial preparations. Whenever the habit is impregnated with mercury to a certain degree, which the state of the salivary glands, and other constitutional effects sufficiently indicate, the patient remains quite free from the danger of abscess. I have long thought that when such a misfortune does occur, it is to be attributed to want of medical skill, or to the application of the remedy at too late a period, after some change of structure, necessarily ending in abscess, had taken place. Though blood-letting, blistering, purging, together with the other parts of the anti-phlogistic treatment, may occasionally be useful, they are not to be put in competition with a proper use of the oxides of mercury, without which we can seldom remove any severe affection of the liver, whether it be acute or chronic.

Entertaining this opinion of mercurial preparations, I was yet

very frequently much dissatisfied with their effects. Patients labouring under hepatitis were often freed from the risk of abscess; but a state of such extreme weakness, perhaps, had been induced by the disease, or by the remedies employed to subdue it, that, on a recurrence of the disorder, they resolved to endure all the miseries attending it, rather than return to a treatment which they had found to be so distressing. In this resolution they might persist for a time, but at last would fly to the remedy as a less evil than that by which they were kept in a state of suffering so exquisite and so hopeless.

In my first trials of the nitric acid as a substitute for mercury, and indeed for a number of years, I used the acid procured from impure Bengal saltpetre by means of alum. The acid thus obtained was really a mixture of the nitric and muriatic acids, the latter being derived from the muriates of soda, of lime, and of magnesia, with which that salt is so largely contaminated. I long believed that all the good effects, which I saw this acid produce, arose from the *nitric acid* alone, and I took measures at last to get it in a state of very considerable purity.* In the effects, however, of my purer acid, I was sadly disappointed; for although it did by no means cease to produce some salutary consequences, yet they were less decisive, less valuable, and of a different kind. I now reflect with satisfaction, that I published at that time an account of my materials and my process, so that the public had the same means of forming a judgment that I myself possessed.

In a paper on the nitric acid, printed in India, in the year 1796, and reprinted in London, I gave an account of my process, and of the materials used for obtaining it, to which I added the following words: "As the nitre that I have used contained about six per cent. of sea salt," (here I seem to have taken no account of the other muriates,) "it will be evident, that the acid which I obtained is not a pure acid of nitre, but it is a mixture of the acid of nitre and oxigenated muriatic acid; or it is an aqua regia, in which the marine acid bears a small proportion to

* See No. II. of the Journal of Science and the Arts, 1816.

the acid of nitre; as this is precisely the case with the acid of nitre from Apothecaries' Hall, with the effects of which I was well acquainted from experience, I was less anxious to separate from my nitre the whole of the marine salt. This is the acid that I used in all my trials. It is more agreeable to the taste than the acid of Europe, and more salutary, if I mistake not, in the living body."

I left India in very bad health, and long remained ill in this country. During this period I often reflected on my experience with the acids, and resolved, as soon as an opportunity should occur, to return to the use of the nitro-muriatic acid, and to satisfy my mind on the subject from further observation. Above a year ago I came to London, and had an opportunity of getting the nitro-muriatic acid employed to a considerable extent. At first I mixed three parts of nitrous acid with one of muriatic, in order to imitate the acid I had used in India. Of late, however, I have employed the acids in equal weights, and I give a preference to this proportion; but there may be others still more efficacious, which time will discover.

Although I had reason in India to be satisfied with the general effects derived from this acid, yet considerable inconvenience attended its internal use. If it were not given with great caution, it injured the enamel of the teeth, though not their roots, as mercury does. Even in small quantities, it disagreed with some stomachs; and few individuals indeed could continue it sufficiently long, or in a sufficient quantity, to remove from the system the symptoms of secondary syphilis. These difficulties made me anxious to ascertain whether or not the acid externally applied would produce good effects. I accordingly employed it in this manner in various cases,* and I immersed my own body up to the chin in a bath of this acid, sufficiently diluted with water. I fortunately have preserved the memoranda that I made at the time, of which the following is a copy.

* See a letter published in July 1797, and republished in Dr. Beddoes's Collection.

"*Bombay, 27th April*, 1798. I bathed to-day in an acid bath, which was merely acidulous. It covered the whole body below the head. I staid in it for half an hour, and it was nearly of the temperature of the body. I feel no particular effect from this bath. It is fully as pleasant as water, and cleanses the skin like a soap.

"*April* 28. I bathed again to-day, keeping the bath at the same temperature, or making it rather higher, and of the same strength with regard to acid. I staid in it half an hour. I still feel no material effect from the bath. Pulse after bathing 76°. The only apparent action of the acid is on such animal matters as are unprotected by life, with which it forms an acid soap. Would it not deprive feathers of their oily smell?

"29th. Bathed again, and continued as before for half an hour in the bath. To-day the bath was hardly so hot as the body. About half an hour after bathing yesterday, I became sensible of an odd sensation about my gums, my jaws, and my teeth.

"30th. Bathed again, and staid half an hour in the bath. It was rather warmer than my body. Since yesterday I have been sensible of some uneasiness in my throat on swallowing. I feel a disposition to salivation at times, but I am otherwise well. My gums, both above and below, are somewhat reddened. I was, for some time, disposed to ascribe these effects to imagination, but they have continued all this day, and leave me no doubt of their reality. I am in good health.

"*May* 1st. Since yesterday I have felt some pain in my throat, especially on swallowing. This pain seems to follow the course of the œsophagus. During the whole of this forenoon I had a sense of *burning* over the roof of my mouth, and down the gullet. This sensation is like what arises from having chewed an acrid vegetable substance; and is so unpleasant, that unless it leave me by to-morrow, I shall bathe no more. To-day I bathed as usual, staying in the bath for half an hour. It has been to-day, and is, in general, so acid, as to make my skin smart a good deal in many places.

"2d. My mouth, &c. though not in the least ulcerated, is

somewhat pained. I am sufficiently convinced of the great power of this bath, and shall bathe no more. My digestion is improved, and I feel that my liver, unclogged by disease, is doing its office with facility, which, for some time past, has not been the case with me.

" 6th. I have not bathed again, but I still feel the effects of the bath in my mouth. My appetite is now good, and I sleep with tranquillity, which I had not done of late. With all this, my pulse is quicker than usual, and I am sensible of some degree of languor. It is, however, to be observed, that the weather is very hot; the thermometer being, during the day, in the shade, from 92 to 96 degrees of Fahrenheit.

" In order to get a delicate test for acidity or alkalescency, I have been accustomed to rub the red petals of the *hibiscus rosa sinensis* on white paper, where they leave a blue-coloured stain. I observe, when under the influence of the bath, the urine no longer turns this colour red, but destroys it altogether.

" *June* 6th. For a fortnight after giving up the bath, I was sensible of some of its effects about my mouth, and my pulse remained too quick. I am now remarkably well. My liver seems to be sound, and I have experienced a happier change than I ever did from mercury."

After this I used the nitro-muriatic bath in a variety of cases, and often with agreeable results. I now wrote another letter, giving an account of its powers: this letter was published in London, but it attracted very little attention, being tried by few individuals. When I came to London, and had it in my power to have the nitro-muriatic bath employed for various states of disease, I was, as may be supposed, very anxious to know if it could be as commonly applicable in this climate as it is within the tropics. I have been much pleased to discover, that it gives here the very same results that I formerly derived from it; nor are the maladies for which it may bring relief, less general in this country than in India. On the contrary, they seem to be still more abundant.

The acid that I have used of late is the nitro-muriatic; and it is formed by mixing together equal parts of the nitrous, or nitric

acid, and muriatic acid. If these acids be in the state of concentration that they usually possess in the shops, and if the quantities be considerable, a great volume of gas is evolved on their coming into contact, which taints every part of a house, is extremely hurtful to the lungs, and disagreeable to the smell. To avoid all this inconvenience, I put a quantity of water, at least equal in bulk to both the acids, into a bottle, and I add the acids to it separately. This method does not only prevent the unpleasant odour, but it tends to retain the chlorine on which its effects depend. It is well known that the nitro-muriatic acid acts very readily on the metals and earth; nothing therefore but glass, or extremely well glazed vessels of porcelain, should be used to contain it. Wooden tubs for bathing answer very well, and they should always be made *as small as possible*, compatible with their holding the body, or the limbs that we wish to expose to the bath. From their being small we save acid, and are able to heat the bath with ease. In India I have often exposed the whole body below the head to this bath; but here I have been satisfied in general by keeping the legs and feet exposed to it. In order to warm the baths after the first time, I have commonly made a third or a fourth part of it to be thrown away, and the loss replaced by boiling water, and a proportional quantity of acid. To save the expenditure of acid, I have occasionally warmed a portion of the bath in porcelain vessels placed near the fire, but I fear this may diminish its effects.

It is no easy matter to give directions with regard to the degree of acidity of the bath. I have commonly made it about as strong as very weak vinegar, trusting to the taste alone. The strength should be regulated by the degree of irritability of the patient's skin. I may say, that although I like to know that it is strong enough to prick the skin a very little, after being exposed to it from fifteen to thirty minutes, yet I believe that even such an effect as this is unnecessary.

The time, too, of remaining in the bath, in order to produce the greatest effect, is a matter of doubt; I have kept the legs and feet exposed to it for half an hour or more; but with more delicate peo-

ple not above one-half, or one-third of that time. I have repeated these baths daily, or even twice or thrice a-day.

I must now observe, that the mere sponging the skin with nitro-muriatic acid, sufficiently diluted with water, gives rise to the very same effects with bathing, and is more easily applied. Fifteen or twenty minutes may be employed in the sponging, though I have found that a much less time does produce very material effects. When the bathing or sponging is carried to a considerable extent, and when the system is much under its influence, a sense of weakness comes on occasionally, some nervous irritation and restlessness are felt, a taste of metal (generally compared to that of copper) becomes sensible; a sense of pain occurs in some part of the palate or mouth, which is not permanent, but comes and soon goes off again. At length little specks or small ulcerations, extending no deeper than the cuticle, are seen on the interior surface of the mouth, and over the tongue, so that some degree of excoriation or rawness is at last produced. This is attended by a considerable discharge of saliva, with an increase of the feeling of lowness or depression. These effects resemble those of mercury, but they are not the same. The excoriation from the nitro-muriatic acid never reaches deeper than the cuticle: it never gives rise to fœtid ulceration of any kind; nor does it produce the least offensive smell of the breath nor in the mouth. The effects of it in this way are surprisingly fugitive. At one hour the discharge of saliva may be excessive; the next it will stop, and perhaps suddenly come on again. The excoriations in the mouth generally go away in a day or two, if the remedy be discontinued, and appear no more. While the mouth in this way is affected by the acid, the teeth partake of uneasiness; but I never saw this in a considerable degree, nor have I known any injury done to the teeth or their sockets. These last-mentioned effects are seldom met with to the extent that I have described, and need not be excited unless some peculiar circumstances require an unusual power, such as the symptoms of syphilis. I have lately added more and more of the muriatic acid in proportion to the nitric, and the effects have proportionally increased. I now make use of equal parts of the acids. Would not the greatest power of the remedy be obtained by those pro-

portions that produce the greatest quantity of chlorine; for from that element I believe all its effects arise? I am yet ignorant what effects would be produced by the muriatic acid alone.*

The nitro-muriatic acid appears in a particular manner to affect the glands, and to alter their secretions; and on this power a great part of its value in derangements of the liver seems to depend. It sometimes very suddenly increases the secretion of bile; and this effect may be kept up for a length of time. It increases the perspiration, and often to a great extent. Whether the nitro-muriatic acid be applied to the inner surface of the stomach, or to the external surface of the body, the effect is the same in kind, though not in degree. As a very general rule for its employment, it may be observed, that whenever the mercurial preparations are indicated, the nitro-muriatic acid will be found useful, with this difference, that in cases where mercury is highly injurious from delicacy or peculiarity of constitution, or from other causes, the nitro-muriatic acid may be employed with safety and advantage. On the other hand, I should not at present recommend it in acute diseases, with the exception of some kinds of fever, and of hepatitis of every character. Where the pulse is quick, and where there is an inflammatory tendency, I think it would be injurious.

I was first led to the use of the nitro-muriatic acid from an attention to the diseases of the liver. The derangements of that organ, and of its secretion, open a vast field for enquiry, which has been but imperfectly explored. I shall, as an example of the application of the nitro-muriatic acid, say a few words on this important subject.

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### *Acute and Chronic Hepatitis.*

With regard to acute hepatitis, if pure and unmixed, the propriety of employing the nitro-muriatic acid might admit of a

* Since I wrote the above, some of my friends, as well as myself, have used for sponging the skin, chlorine dissolved in water, and with the same effects exactly as arise from the union of the acids.

doubt; but the same observation may be applied to mercury. I think, however, that I never met with a case of acute hepatitis, that did not partake of the chronic affection, either at its commencement or soon afterwards. I know from experience, that within the tropics, where I lived so long, a proper use of mercury is never to be neglected in either affection of that organ. I have not trusted to the acid where I thought the risk of abscess considerable; but without delay have employed mercurials, and every other means in my power, to prevent, if possible, a termination so lamentable I should now not hesitate to add this new power to the other means; and have no doubt, if really insufficient of itself, it would greatly aid us in affording security and relief.

Chronic hepatitis is a far more common disease than the acute; but it may be considered as always partaking of the nature of both. One portion of the same liver is often insensible, enlarged, and inactive, while another part of it is suffering from all the symptoms of acute hepatitis, and going on to the formation of pus. It is this mixed disease that we meet with so generally in India, as well as in this country; and it is this state of the liver which gives rise to so great a variety of anomalous symptoms.

For this chronic affection, it appears to me, that the nitro-muriatic acid applied to the skin, is the most effectual, and the safest remedy. A few hours, or even a single hour, will sometimes bring relief; but it is necessary to continue the remedy till the system be sufficiently affected by it, and to repeat it occasionally *till the patient has recovered his usual degree of strength.* This is a rule in affections of the liver, of the utmost importance. A state of weakness, however produced, is the great remote cause of those chronic affections; so that we may remove the disease, but till the strength and vigour of the circulation be restored, we have no security against a return of it.

This affection of the liver produces a vast variety of diseases, to which various names have been assigned. To describe them well would require much time, and occupy many volumes. The process of digestion has an intimate connection with the bile; if this be depraved, the stomach and intestinal canal partake immediately of the disorder. The brain, which seems to be the source

of feeling and motion, is connected by means of numerous nerves with those abdominal viscera, by which so many of the functions of life are carried on. A diseased state of the bile has a wonderful influence on the whole nervous system: it gives rise to pain and giddiness of the head: a great dislike to motion, and a sense of weakness, rather than actual weakness: cramps come on in the legs while asleep: the soles of the feet are tender and painful, and at times the sick rather drag them than raise them when they walk. A most able and intelligent friend, who was lately relieved very suddenly by the nitro-muriatic acid bath, from a state of long continued nervous irritation, is of opinion, that all the misery he had suffered for years arose from a depraved state of the biliary secretion. His observations on himself are curious and very important. He had long taken notice that the bile, though at times ample in quantity, was insoluble in water, and that the fæces had lost entirely the fæcal odour. The solubility in water, with this peculiar odour, gradually returned from the use of the remedy, while at the same time the irritable state of the nervous system was suddenly corrected. But I think there is sufficient evidence that this acid in some cases acts directly on the nervous system; for in some people I have seen it very suddenly produce a sense of composure, of quiet, and of happiness, and for days together they have been sensible of a degree of an agreeable intoxication.

There are other symptoms, though less obscure, perhaps, in their origin, that are often connected with the chronic affection of the liver. The blood cannot pass through it with the facility necessary to health, nor is it possible to relieve it effectually from such a state, but by giving solubility to the bilious matter. It then passes off abundantly through the proper channels into the duodenum. If from obstruction or enlargement the blood be prevented from circulating with ease in the liver, a general disorder of the whole frame becomes apparent. The feet and ankles swell, and a fulness in the head comes on, with headach and giddiness, and a train of unhappy feelings. In this country it is a common practice to have recourse to the abstraction of blood by cupping, or by the lancet, in order to alleviate such symptoms. The first effect of this practice is, no doubt, occasionally to give

relief to the head; but this is only temporary. An equal quantity of blood is again accumulated; a repetition of blood-letting is required; the state of weakness continues to increase; and the patient falls a victim at last to an injurious practice, derived from a theory altogether erroneous. It is not by letting off a part of the blood, that we can do any good; for it is neither too abundant in quantity, nor bad in quality. The fulness of the head, as well as of the feet, does really arise from the remora to the blood in another portion of its circuit; and in both extremities of the body it is produced by one and the same cause.

I need hardly say that melancholy and despondency of mind are often connected with a peculiar state of the bile, for this has been observed in all ages. This state of mind I have often seen removed by a proper use of the nitro-muriatic bath; and people of both sexes have assured me that they think it had preserved them from the crime of suicide, to which, during the horrors of their feelings, they had an alarming tendency.

That state of the bile already mentioned, in which it seems to be deficient in quantity, and probably at the same time unhealthy in its nature, is very common. Of all hepatic affections, I think this attended with the most pain and distress of the bowels. This disorder of the biliary system frequently gives rise to a flux, which I have known to go on for many months, and even for years. I have generally seen a deficiency of bile without a tendency to flux, and often even accompanied by a constipated state of the primæ viæ. Such a condition of the liver and bile does frequently give rise to most uneasy derangements of the stomach; a tendency to acidity or heartburn; little ulcerations over the surface of the mouth and œsophagus, and perhaps extending downwards through the whole track of the intestinal canal. This aphthous disease is very distressing and dangerous, though I have been very successful in curing it by the nitro-muriatic acid. I know of no other remedy for this affection of the stomach and intestines, as the common means of cure seem to me to be very far from sufficient.

I may say with truth, that in such a condition of the liver and bile, all remedies that stimulate or excite the circulation are *injurious*. Among such I may reckon wine, spirits, bark, bitters, and

steel. With such agents opium has been classed; but many of its effects are peculiar to itself, and a proper application of it in such complaints is often of the utmost importance and utility. In almost every state and stage of diseased liver, opium may be given to many with benefit. Even in acute hepatitis it answers a salutary purpose when combined with calomel, or with the quicksilver pill: for, unlike what occurs in other inflammatory affections, it seems in those of the liver to be unattended by almost any ill effect. In chronic hepatitis, it alone is able to calm the irritability and unhappy feelings, and to allow time for the application of the means of cure. It seems, indeed, by its sedative power, to have a beneficial influence on the liver, and perhaps to do something more than produce a temporary calm. Opium, however, should never be given in chronic hepatitis, without great attention to its effect in diminishing the propulsive motions of the primæ viæ. I have been accustomed to give an opiate at bed-time, together with some laxative substance, such as the sulphate of magnesia, to correct its constipating effect.

It is proper to observe, that bilious people, and especially those who have been subject to intermittents, after finding the utmost relief from mercury, or the nitro-muriatic acid, and at the moment when we think they are advancing fast towards a perfect recovery, are apt, all at once, to say they are unwell; to lose their appetite, to become a little feverish, and to complain of their head. If these symptoms be neglected, the patient soon gets regular attacks of a quotidian fever, beginning with a cold fit, and followed by the ordinary stages of that disease. Such is the connection which a great flow of bile, however excited, appears to have with fever of the intermittent kind.*

* Although I have not seen this fever under a violent form, yet it is depressive and inconvenient. It is easily stopped by the Peruvian bark, taken daily in decoction, before the hour of the fit, and repeated at the same time for a few succeeding days. A common wine glassful of it, every two hours, and repeated for three or four times before the fever is expected, I have always found to be sufficient for curing it. With some people, I judge it prudent to give the bark decoction during the whole of the time they use the acid. It is often very useful to add a few drops of laudanum to each glassful of the bark decoction.

Besides this fever, which is of the true intermittent kind, there is very generally a troublesome symptomatic fever, that plagues bilious people. It steals on imperceptibly, and, when once begun, gives rise, with little other inconvenience, to a state of most obstinate sleeplessness. This too may be obviated by an opiate, given before the hour of its accession; but it can be cured only by correcting the cause of it. Opiates with bilious people are very apt to occasion great itching of the skin, by delaying the passage of the bile through the bowels.

From a diseased state of the bile the memory is often affected, and a degree of stupidity, and even of idiocy, comes on. From this cause, too, the hair at times grows harsh and hard to the feeling, and I have seen it, like the skin, become soft and flexible from the use of the nitro-muriatic acid. In both cases I imagine that the effect arises from the long suppressed matter of perspiration being abundantly restored. To all these I may add, another inconvenient complaint from a bilious state: a frequent desire to pass the urine. Whether this irritation arise from a diseased sensibility of the whole nervous system, or from a morbid alteration in the urinary fluid, I do not know.

In all biliary derangements the rule is never to be forgotten, and I repeat it again, that *there is no security against a relapse, till the health and strength are fully restored; and that till then some repetitions of the remedy are necessary.*

The good effects of the nitro-muriatic practice can never be appreciated, until it has been discontinued for several weeks or rather months. During the use of the bathing or sponging, the pulse is often very quick, and patients grow thinner, even when they feel better. At times, too, they often complain of more than usual uneasiness in the liver, or in the region of it; they often lose their flesh, and look very yellow. The remedy seems to alter and agitate that organ. The flow of bile, when once excited, goes on for a number of days; and not, with some people, without inconvenience. If it do not affect the bowels as a laxative, it is highly necessary at this time to employ some substance that has this power, such as the sulphate of magnesia, senna, or aloes. In

time, however, it is commonly found that the health, the strength, and the colour of the skin are much improved.

It is no small advantage of this practice, that we can apply the power in as high a degree as the strongest can bear, or in quantities so minute, that the most sensitive and nervous being can hardly be injured by it. I have immersed many to the chin in this bath, and I have been afraid, in other cases, to wet more than a single hand with the acid. The length of time, too, that the acid remains in contact with the skin, may be infinitely varied. We have thus a power extremely divisible, and applicable to almost every degree of resistance or sensibility.

When the acid produces very considerable effects, it is right, after a few days, to stop its use for a week or two; as, if used long, it gives rise to unnecessary uneasiness from bilious discharges or bilious feelings. I have said that drinking the nitro-muriatic acid has the very same effects with its external use. When taken in this way, it should be very much diluted with water. Indeed it should taste but very slightly acid, and be drank in small portions at a time. I need hardly say, that it is very necessary to take care that, even in this weak state, it be not allowed to touch the teeth. The mouth should be immediately washed after swallowing it, and every precaution employed, that is used with the mineral acids, to prevent injury from its external action. This way of using the nitro-muriatic acid is often very convenient and salutary, and in many cases may deserve a preference to any other. I think it is particularly applicable to some states of indigestion, and when we wish to produce effects gradually and insensibly.

On what principle to account for the singular agency of this compound acid on the skin, I confess myself in great doubt, or rather *in total ignorance*. That its power depends on chlorine, an elementary substance according to Sir Humphry Davy, there cannot be a doubt. The almost instantaneous effects that it produces on some people, its operation on the stomach, which it stimulates occasionally to contraction, and its suddenly causing a flow of bile, are all unlike a remedy that is conveyed by the known channels of absorption. In my opinion, the taste and the

sensation that it occasions in the mouth, are exactly such as are produced by the galvanic fluid, and it would be presumptuous to affirm, that no agency of a similar kind has an influence in the effects of the nitro-muriatic acid. I can suppose that the effects of this remedy do not arise from the transfer of matter by any set of vessels; but that they are the consequence of peculiar motions, which it has the power of exciting in the solids, or the fluids of the body.

I need hardly, I hope, observe, that after the treatment which I have recommended for bilious people, as well as during the employment of the acids, a regular and rather abstemious system of diet should be adopted. I have always thought that food chiefly of a vegetable kind is the most salutary, and that great temperance in the use of wine, or other liquors containing alcohol, is absolutely necessary, if indeed they are to be allowed at all. I perfectly agree in every thing that Dr. Fordyce has said, with regard to the causes of the prevalence of bilious complaints in London. The sedentary occupations of many of its inhabitants, their eating great quantities of animal food and of butter, their use of porter, their living in close and hot apartments, deprived of exercise in the open air, with the sudden changes of a variable climate, are all powerful and sufficient causes of derangement of the liver, the stomach, and the other organs connected so intimately with the state of the bile.

It cannot be supposed that the experience of an individual is sufficient to ascertain the effects of a remedy, that is so widely applicable to medical practice as the nitro-muriatic acid. I have said that it is a substitute for mercury. In general its effects are equal to those of the mercurial oxides in the removal of disease, and in some cases I know that it possesses superior powers to any of them. I cannot give a better notion of the extent of its application in medicine, than by comparing its salutary effects to those of mercury, while with common knowledge and discretion it can do but little harm. If used with the mercurial preparations, it seems to quicken their effect and increase their power.

From the commencement of my search for a substitute for the oxides of mercury, I congratulated myself on knowing the compo-

sition of the nitric acid, and I have had reason, in like manner, to be pleased with a similar knowledge of the substances still more compounded that I have employed with a like intention, and not without success. Although at present I have confined myself to some observations on a few of the derangements of the liver, and diseases of the bile, it must not be supposed, that during so long a period, I have not ascertained its effects in many more of the maladies to which we are subject. Some account of this experience was long ago published both in India and in England.

*Russel Square, April* 1817.

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P. S. Since I wrote the preceding paper, several of my friends have become convinced with me, that the very same effects arise from a diluted solution of chlorine in water, as are produced by the nitro-muriatic acid. Our late experience puts an end to all doubt, if any could have existed, that chlorine alone is the source of the material effects. We have sponged the skin with a solution of chlorine in water, and in many cases, have obtained the same results as arise from a similar application of the nitro-muriatic acid. The solution of chlorine to which I allude, is water through which the *oxi-muriatic acid gas* has been made to pass, until it could retain no more of it. This mode of applying chlorine has the advantage of not irritating the most sensible skins so much as the diluted nitro-muriatic acid might do; but even this solution I have diluted with about four times its bulk of water, before I applied it.

It is remarkable that the aqueous solution of chlorine, procured by mixing the acids together, is far less offensive than its solution got by the common means of passing the gas through water. Some degree of affinity seems in the first case still to subsist between it and the other elements of the acids, by which its sensible qualities are diminished to a certain extent. We are under great obligations to Sir Humphry Davy, for the light he has lately thrown on this subject; by which the effects of the *aqua regia* of the chemists are clearly accounted for.

I have of late received from different quarters, and from competent judges, a confirmation of the opinions I had expressed of the effects of chlorine in derangements of the liver, and in syphilitic affections. As those opinions were derived from experience alone, I cannot but think that a future day will confirm them.

I am told that some others have been less successful than myself or my friends with this remedy, and that by the application of chlorine to the skin, they have been unable to produce a sensible effect of any kind. I can make no reply to such opinions, as I do not know how the trials on which they rest have been conducted; but I must affirm, that I have, sooner or later, been able to produce very distinct effects in almost every case in which I have employed it. Time will decide between us; but on one side of the question I need not say, there is a want of right observation.

If it be considered, that the most active of all the mercurial preparations in use, are calomel, (submuriate of mercury,) and corrosive sublimate, (oxymuriate of mercury,) we may ascribe this great activity to the chlorine of the composition. Why the sanative powers of the mercurial preparations were supposed to arise from the metal alone, I cannot conceive. In like manner, the chemists for a long time neglected the water that might be mixed with the materials of their experiments, the elements of which water gave rise to effects that misled them in all their reasonings. I am now nearly, I think, in a condition to shew what effects in the system arise from mercury as a metal, and what effects are derived from the other element of the mercurial preparations, whether this metal in them be combined with oxygen or with chlorine.

*June* 3, 1817.

*Chemical and Physiological Researches on Ipecacuanha, by Messrs. Magendie and Pelletier; read before the Academy of Sciences of Paris, on the 25th of February, 1817. Translated from the French by N. Cussens Nancrede, M. D. &c. &c.*

Few medicines have occupied the attention of authors more than Ipecacuanha; its uses in medicine have been ascertained by a prodigious number of researches; since the publication of several dissertations by Messrs. De Humboldt and Bompland, and of a memoir by Mr. De Candolle on the genera and species which furnish the different varieties of this plant, scarcely any thing is wanting to complete our knowledge of its natural history. But with its chemical history we are by no means so well acquainted: the analysis of its different species remains yet to be made, as also to seek whether the power which it possesses of vomiting resides in any substance which can be separated, and whether this substance is identical in the different species or varieties, or whether it differs in these species; on either of these suppositions, what effect does this substance, as pure as it can be obtained, produce in the human economy? These considerations have necessarily induced a division of this paper into two distinct parts: the first we have thought proper to denominate chemical; the second physiological.

## 1. *Chemical Part.*

Ipecacuanha has been examined by several chemists; but the results of their labours are contradictory; they could not therefore guide us in our researches; among the most important we will mention the dissertations of Mr. Henry, Dr. Irvine, and Mr. Masson-Four.

Mr. Henry found in ipecacuanha a resinous and an extractive matter; the latter soluble in water; both possessing the power to vomit. Mr. Henry considers the resinous matter as possessing this power

in a higher degree. An account of these experiments is to be found in the 57th vol. of the Annales de Chimie.

We have not been able to procure a copy of Dr. Irvine's paper; but, if we may be allowed to judge from a passage in Thomson's Chemistry, his experiments are far from being satisfactory. We will insert the whole of the passage mentioned by Thomson; it proves the necessity of a new analysis of ipecacuanha.

" Notwithstanding the great importance of this article to medicine, (ipecacuanha,) no correct analysis has as yet appeared; the latest experiments were made by Dr. Irvine, who received in 1784 the prize of the Harveian Society of Edinburgh. From these experiments, it appears to contain a gummo-resinous matter, in which principally resides its activity; probably it contains also pure resin and extractive. When this root has been boiled for a long time in water, it loses its caustic powers; if it be distilled with water, the liquid which ascends is inert, but the decoction remaining in the retort operates powerfully on the economy."

In the first volume of the Bulletin de Pharmacie, we find Mr. Masson-Four's paper; he ends with the following conclusions, which are briefly the results of his labours.

" It may then be concluded, that ipecacuanha, as we receive it in commerce, contains, 1. gallic acid; 2. mucilage; 3. extractive; 4. resin.

" That extractive and resin appear to be the active ingredients of this root; that alcohol at 36° dissolves the resin, the gallic acid, and part of the extractive; that water dissolves the mucilage and gallic acid, but does not appear to retain any considerable quantity of resin."

Notwithstanding the importance of Mr. Masson-Four's labours, they do not give us results sufficiently satisfactory to induce us to abstain from a new series of experiments on this subject: we have endeavoured to undertake them. We are perhaps far from having attained the wished-for object; yet as our experiments have given us interesting results, we will make them known, as materials which may prove of some utility to a general undertaking on this head.

In this memoir we will call the attention of the academy only

to the three species of ipecacuanha that are most usually employed: brown ipecacuanha, taken from Psychotria emetica, grey ipecacuanha, from calicocca ipecacuanha, and white ipecacuanha, afforded by the viola emetica.

### *Analysis of brown Ipecacuanha (Psychotria emetica).*

The bark of the root of ipecacuanha being known from experience to possess more active properties than the ligneous or meditulleous part, from which it is easily separated, we thought proper to separate and employ it in our first experiments: we pass in silence over the preliminary trials that we made on this substance, and proceed to the mode of analysis which, from the knowledge we had, we thought proper to follow in its examination.

A certain quantity of powdered bark of ipecacuanha was submitted to the action of rectified sulphuric ether, first cold, afterwards hot, then with the addition of more ether. Thus was the action of ether upon ipecacuanha exhausted; it was then dried in the water bath. The tinctures evaporated produced an ether, which, during the first moments of distillation, had no foreign smell, but towards the end of the distillation they evidently had that peculiar to ipecacuanha. There remained in the retort a fatty, oily, odorous substance, of which more hereafter.

The ipecacuanha thus exhausted by sulphuric ether was submitted to the action of alcohol at 40 degrees, assisted by heat; a great deal of time and alcohol was necessary to separate from the ipecacuanha all the parts soluble in this menstruum; the first tinctures were of a brownish yellow; they had not the beautiful gold yellow which distinguished the tinctures of ether.

The alcoholic tinctures filtrated while boiling, precipitated a few white flakes of a matter we found analogous to wax; the liquors filtrated, gave by evaporation an extractive matter of a saffron red: this matter dissolved in cold water left flakes of wax, which were separated by filtration, and united to those already obtained.

The matter soluble in cold water was obtained by evaporation in the water bath; it was then of a brownish red, very deliques-

cent, bitter, and almost without odour; experience has shewn us it possessed very marked vomitive properties, as we shall notice farther on; it slightly tinged red, blue vegetable colours.

This extractiform matter was then put in contact with carbonate of barytes; after a few days, the matter was at first taken up by water, afterwards by alcohol; it had ceased to redden vegetable blue colours; besides, it did not contain a single particle of barytes. Barytes had then only taken up an acid, which had imparted to it the power of reddening *litmus;* but there was so little acid in the extractiform matter, that we could not separate it. Yet we hold ourselves bound to consider this acid as gallic acid, because, before it was treated by barytes, the extractiform matter changed the solution of acetate of iron to green.

Acetate of lead was added little by little, and by portions, to the matter previously redissolved in distilled water; a considerable precipitate of a greyish white, but still identical, notwithstanding the lapse of time since its formation, as actual observation convinced us, was instantly formed.

This precipitate was collected by filtration, and the filtrated liquor was almost colourless; another portion of liquor, into which sub-acetate of lead had been thrown, was perfectly discoloured.

The precipitate obtained by the acetate of lead was washed with distilled water, and decomposed by a current of sulphureted hydrogen; the lead by this process was separated from the matter which we call *vomitive*, and the matter was itself obtained by evaporating the liquor; but as it retained a little acetic acid, it was put in contact with an excess of powdered litharge, and afterwards treated by sulphureted hydrogen.

We look upon this experiment as one of those which we consider as decisive in establishing the homogeneous nature of this matter; for if it had been composed of two different substances, and the one so composed as to be precipitated by the acetate of lead, the other on the contrary not—then this reagent could at first have been used to separate those two substances; either the one or the other could have been precipitated by this salt. But it is probable that in this case one would have been so before the other,

and thus a difference would have been found between the precipitates of different dates: besides, the other properties to be enumerated hereafter, when we shall speak particularly of the vomitive matter, confirm us in this opinion. But we will continue our analysis.

The ipecacuanha, being now no more acted upon by alcohol, was treated by cold water; which, having remained a considerable time on it, became mucilaginous; when filtrated and evaporated, it gave a greyish matter, which, treated by alcohol, whitened, leaving a certain portion of vomitive matter analogous to that we have just mentioned. This white matter, on being carefully examined, was found to possess all the characteristics of pure gum; on treating it by nitric acid, it gave oxalic and mucous acid. The ligneous matter, after having been exposed to the action of cold, was submitted to that of boiling water, which took from it a considerable quantity of a substance, which we found, upon examination of its characteristics, to be starch. In order to form instantaneously a beautiful blue colour, it is merely necessary to pour into the liquor a certain quantity of iodine; the fibrous matter, which remained after it had been boiled at different times in water, had all the properties of the ligneous matter; but one thing which is worthy of notice is the close connexion which subsists between the starch and ligneous matter. These two substances were so intimately connected, that, after it had been boiled eighteen times in fresh water, the ligneous matter still retained a certain portion of starch. This analysis was repeated several times; the medium of our results has given us the following proportions for each of the before-mentioned component parts:

| | |
|---|---|
| Fat oily matter . . . . . | 2 |
| Vomitive matter . . . . . | 16 |
| Vegetable wax . . . . . | 6 |
| Gum . . . . . | 42 |
| Starch . . . . . | 20 |
| Gallic acid, traces of it | |
| Loss . . . . . | 14 |
| | 100 |

The ligneous, or internal part, or meditullium, and the root of psychotria, have likewise been analyzed by us.

The following are the results we have obtained:

| | |
|---|---|
| Vomitive matter . . . . . | 1.15 |
| Extractive matter not vomitive . | 2.45 |
| Gum . . . . . | 5. |
| Starch . . . . . | 20. |
| Ligneous matter . . . . . | 66.60 |
| Gallic acid and fat matter, traces of | |
| Loss . . . . . | 4.80 |
| | 100. |

We have mentioned in these results an extractive matter not producing vomiting. This matter, which very much resembles the extracts which are commonly obtained from most ligneous substances is not easily separated from the vomitive matter, whose power it weakens. It not being precipitated by gallic acid or the tincture of galls, causes it to differ essentially; for very copious precipitates are formed by the vomitive matter with those reagents. The non-vomitive extract may be separated from the vomitive matter by this process. In this instance the precipitated compound should be treated by barytes, which decomposes it, and the vomitive matter dissolved in alcohol. The small quantity of vomitive matter found in the meditullium of ipecacuanha proves the correctness of apothecaries in separating the ligneous matter from the root, in the preparation of the powder of ipecacuanha.

We will now carry our attention to the chemical analysis of the fat matter extracted from the ipecacuanha, and to the study of the powers of the vomitive matter. We shall not make mention of any thing concerning the other substances found in ipecacuanha, they being identical with substances already well known.

### *Of the fat matter found in Ipecacuanha.*

The fat matter which is extracted from ipecacuanha by sulphuric ether is of a beautiful brownish yellow when in *masse;* but when

dissolved in alcohol or sulphuric ether, it imparts to them a colour of a gold yellow; when put in the mouth, it affects particularly the throat and velum palati, and is of an acrid taste, such as essential oils; it has a very strong smell, resembling that of the essential oil of horse radish; when heated, it becomes insupportable; when weakened by the addition of a vehicle, it is perfectly analogous to that of ipecacuanha, and it is to this matter that is due the smell of ipecacuanha. The fat matter is heavier than alcohol; its weight differs little from that of water; heat separates from it a very volatile oil, which has a very penetrating odour; but the greatest part of the matter decomposes before it *volatilizes*, and furnishes then, substances, which give by the action of heat, very hydrogureted vegetable substances; and the oil which ascends during distillation is entirely empyreumatic.

If, on the other hand, we distil water with the fat matter, the water only takes up a part, which afterwards floats upon the surface, forming irises. The fat matter of ipecacuanha appears then like several other vegetable oils, composed of two oils, the one volatile, very fugacious, which gives to ipecacuanha its odour; the other fat, fixed, with little or no smell; this, some chemists, who have not obtained it isolated and wholly free from the vomitive matter, have mistaken for resin.

We will hereafter treat of the action of the fat matter on the human economy.

### *Of the vomitive matter found in Ipecacuanha.*

This substance, which we will denominate *vomitive* matter, although we have not as yet mentioned the experiments which decide that it possesses this power, and which we should be at a loss to call otherwise, is obtained by following the process already mentioned. Yet as we have simplified this process, we will in a few words make it known. The ipecacuanha is to be pulverized, then treated by ether at 60 deg. in order to dissolve entirely the fat odorous matter; when the ipecacuanha is no more acted on by the ether, it is to be exhausted by alcohol; the alcoholized tinctures are then to be evaporated in the water bath; and the matter

redissolved in cold water, abandons its wax, and a little fat matter which it had retained; when laid to macerate on carbonate of barytes, it loses its gallic acid; redissolved by alcohol, and evaporated to dryness, it becomes pure.*

The vomitive matter, when dried, assumes the form of transparent scales, of a reddish brown colour; it has scarcely any smell; yet that little it has is rather analogous to that of *caromel;* its taste is a little bitter, somewhat acrid, but not nauseating; heat in a less or greater degree than that of boiling water, does not cause it to undergo any change; exposed to a greater degree of heat, it swells, blackens, decomposes, and affords water, acetic acid, carbonic acid, and a very small quantity of oil; a very light spongy charcoal remains; in the products of distillation, no trace of ammonia is to be seen, which shews that this substance contains no azote; exposed to the air, it undergoes no other change than to become deliquescent, by absorbing the hygrometrical water; it is dissolved in every proportion by water, without changing it; no means are known to procure it crystallized.

Diluted sulphuric acid has no effect on this matter; when concentrated, it destroys it, and reduces it to a charcoal; nitric acid, when cold or hot, dissolves it, and changes its colour to a deep red; by continuing the action of the nitric acid, its colour changes to yellow; a great deal of nitrous gas is evolved, large quantities of oxalic acid are formed, but no yellow bitter matter.

Muriatic and phosphoric acids dissolve, but do not change, the vomitive matter. It can be extracted from those solutions by saturating the acids. Acetic acid is one of the best solvents of the vomitive matter; it is, on the contrary, precipitated by gallic acid from its aqueous or alcoholic solutions, by uniting very closely with it; the precipitate is very considerable and flaky, little soluble, yet a certain quantity remains dissolved in the liquor. The vomitive matter has, as we shall see hereafter, lost the property by which it is best distinguished.

* Carbonate of magnesia may be substituted to carbonate of barytes or alumine in sweet-meats; as in this process the apothecary will avoid employing a substance which might cause some fears to physicians who may wish to employ the vomitive matter.

Tincture of galls precipitates the vomitive matter still more readily than gallic acid.

Oxalic and tartaric acids have no effect on the vomitive matter; alkaline solutions, when slightly diluted, produce in it no change; concentrated, they alter and entirely change the nature of it. Alkalis decompose and dissolve precipitates formed by gallic acid and galls with vomitive matter.

Iodine dissolved in alcohol, and poured into an alcoholic solution of vomitive matter, produced a red precipitate, which appeared to us to be a combination of iodine and vomitive matter. The small quantity we obtained from this precipitate did not allow of a more strict investigation.

Sub-acetate of lead has a more marked action on it than any of the salts whose powers we studied; it precipitates it entirely. The acetate of lead of commerce also precipitates it; but in this instance the precipitate is not as abundant, and the liquor remains slightly coloured: it appears that acetic acid prevents the formation of the precipitate.

The other metallic salts have little or no action on this matter. The pro-nitrate and deuto-clorate of mercury, and the muriate of tin, are the only metallic salts which produce a slight precipitate. The salts of iron have no action on the vomitive matter deprived of gallic acid: it neither renders them turbid, nor decomposes the solution of antimoniated tartrate of potash. This fact was interesting to ascertain, as those two substances are often united in compounding medicines.

The decoction of Peruvian bark produces a slight precipitate in the solution of vomitive matter; but this precipitate is not near as considerable as that produced by the infusion of galls.

Vegetable salts have no action on the vomitive matter; neither have sugar, gum, gelatine, and those other vegetable and animal substances which we have submitted to experiment; nor is the vomitive matter dissolved by ether or oils.

We believe ourselves authorized to consider the vomitive matter as a substance *sui generis*.

The numerous attempts we have made to separate it into several parts; its vomiting properties; the power which chemical

agents, and particularly gallic acid and galls, have on it; the *ensemble* of its qualities, induce us to consider it an immediate principle of vegetables; and the more so as we have met with it in some vomiting plants belonging even to different families, the calicocca ipecacuanha and the viola emetica (vide the analysis of these two substances). We are therefore of opinion that it may be ranged on the nomenclature under the name of *emetin* (Εμεω, vomo), which word will indicate its most notable property, and recall to mind the plant in which it was first discovered, the psychotria emetica.

*Analysis of grey ipecacuanha,* (*calicocca ipecacuanha.*)

We think it useless to state at full length the experiments made by us upon calicocca, because the component parts being the same with those of psychotria, we have employed for the experiments on both substances processes nearly similar: we will merely mention the results. We have operated on the bark of the root deprived of the ligneous meditullium, and we have obtained,

| | |
|---|---|
| Emetin . . . . . | 14 |
| Fatty matter . . . . . | 2 |
| Gum . . . . . | 16 |
| Starch . . . . . | 18 |
| Ligneous matter . . . . . | 48 |
| Loss . . . . . | 2 |
| | 100 |

While comparing this analysis to that of the bark of psychotria, we perceive a great resemblance between the two roots; yet the psychotria, containing more emetin, should be more active: this had already been remarked.

*Analysis of white ipecacuanha,* (*viola emetica.**)

This vegetable has likewise given us a small quantity of emetin; but in this root it is so encompassed by the other elements, that it

* We shall speak again of this analysis, which did not appear as satisfactory

cannot be obtained through the means by which we obtained it in former analyses. Instead of using ether and alcohol, we must put the pulverized roots into a large quantity of water, and prepare from it an aqueous extract. This extract, treated by alcohol at 40 degrees, becomes discoloured, and leaves a brown matter, which we recognised for emetin; and a white matter almost wholly soluble in water, remains. The soluble substance is gum; the insoluble matter was glutinous, and gave by distillation ammonia. We have found neither fatty matter nor starch in the root of viola.

One hundred parts are composed of

| | |
|---|---|
| Emetin . . . . . | 5 |
| Gum . . . . . | 35 |
| Vegeto-animal matter . . . | 1 |
| Ligneous matter . . . . . | 57 |
| Loss . . . . . | 2 |
| | 100 |

### 2. *Physiological and Medical part.*

Unless we add the physiological investigation, and the study of the medicinal virtues of a plant to its analysis, it becomes useless in some measure to therapeutics; we shall therefore examine it in the above-mentioned light.

It became necessary, in the first place, to seek whether among the several component parts found in ipecacuanha, one or more possessed the power to vomit, as the roots themselves did. As this faculty could not be supposed to reside either in the gum, the starch, the ligneous matter, or the wax, it remained to examine the fatty odorous matter and the emetin.

The smell and taste were affected in the same way by the fatty odorous matter, but it acted more powerfully than the powdered root; it was therefore to be presumed, that its effects upon the stomach would be found analogous, but experiment did not confirm

to us as the preceding; but we have not yet been enabled to repeat it for want of genuine samples. It is also our intention to examine roots of other violæ, particularly those in which vomitive powers have been supposed to exist.

us in this conjecture. Strong doses administered to animals did not produce any sensible effects: we also swallowed at different times several grains; a disagreeable nauseous impression upon the olfactory organs and fauces were the only impressions we experienced, and they were but momentary. Mr. Caventon, who was so kind as to assist us in our researches, took six grains in one single dose, nor did he feel sensations more disagreeable. With emetin these results differed widely. A half grain introduced into the stomach of a kitten produced long and violent vomiting; it then fell into a deep sleep, from which it awoke several hours after, with a full appearance of health.

This experiment being repeated on other cats and dogs, carrying the doses of emetin as high as two grains, always gave us the same results, viz. there was invariably, at first vomiting, then sleep, then return to health, after a longer or shorter lapse of time.

These trials emboldened us to try the effects of emetin on ourselves; accordingly, one of us swallowed two grains upon an empty stomach; three quarters of an hour afterwards he felt sick at his stomach, and vomited several times; followed by a marked inclination to sleep. Several students submitted to these trials, and were affected in the same way.

From this moment we thought emetin might be administered without inconvenience in disease, as a vomit. The first trial was also made upon one of us, who, finding his stomach foul, swallowed four grains in two doses, at intervals of a quarter of an hour: a short time after he had swallowed the first, he began vomiting; the second increased it; he was however soon relieved from the vomiting, which soon relieved him.

Several patients have since this, taken emetin as a vomit, the effects were always the same as those of ipecacuanha; neither was the steady and disagreeable smell of ipecacuanha to be dreaded, emetin having no smell, and its taste being gently bitter;*—

* We will remark, that emetin being very soluble, and not adhering to the coats of the stomach, it will be proper not to administer in one single dose all we wish the patient to take, otherwise he might throw the whole up at the first fit of vomiting, which would then cease. It will be necessary to give it at two or three different times, the first much the largest. Four grains of emetin dissolved in four ounces of water, sweetened with syrup, and aro-

we did not think we had ceased our physiological and medical enquiries on emetin merely because we had ascertained its vomitive property. It was important to discover whether large doses of this substance were capable of producing bad effects. To this end, ten grains were given to a small dog about two years old. Half an hour afterwards the vomiting began, and lasted for some time; it then fell asleep, but instead of regaining its health as those before mentioned, it died, during the night following the experiment, about fifteen hours after it had swallowed the emetin. The body was dissected with due precaution; it was found that the animal's death had been occasioned by a violent inflammation of the parenchyma of the lungs, and of the mucous membrane of the intestinal canal extending from the cardia to the anus.*

This experiment, repeated upon several other animals with six grains of emetin, always gave us the same results; several other dogs had the same fate. Emetin, dissolved in a small quantity of water, was injected within the pleura; into the jugular vein; or in the anus, and in the tissue of the muscles, always with the same results: at first, continued vomiting, alvine evacuations, sleep, and death, within twenty-four or thirty hours. On dissection, inflammation of the lungs and of the mucous membrane of the intestinal canal was apparent. On many accounts these conclusions are important. In the first place, it is of great consequence that we should know, that emetin given in large doses is dangerous, and that in this respect it resembles several other vomiting substances, and particularly tartarized antimony. This fact will stagger the general belief, that ipecacuanha can be given in large doses without inconvenience, because its action is supposed to be confined to vomiting,

matized with orange flower water, given in the above-mentioned manner, is a suitable dose for an adult in ordinary cases.

Children may be made to take lozenges containing half a grain of emetin. Two or three will be found sufficient to produce the desired effect

In cases of whooping-cough, pulmonary catarrh, chronic diarrhœa, &c. &c. we have used with advantage lozenges containing one-eighth of a grain; they appear to be a useful substitute for the common lozenges of ipecacuanha.

* These effects are the same as those observed in persons poisoned by antimoniated tartrate of potash. (Vide Memoire sur l'Emetique, par Mr. Magendie.

and that the overplus is rejected in that operation. Besides, does not the special action of emetin on the lungs and intestinal canal, indicate, that we are correct in prescribing small doses of ipecacuanha, often repeated, to those who have colds in their last stage, in chronic pulmonary catarrh, and obstinate diarrhœa?

If the use of ipecacuanha was attended with these beneficial effects, it was natural to suppose that those produced by emetin would be more so. We have been so fortunate as to realize this anticipation. Several persons affected with chronic pulmonary catarrh, among whom we will mention a lady, sixty-four years old, for three years tormented with a catarrh, accompanied with very fatiguing fits of coughing, morning and evening, who has made use of these lozenges in which emetin entered, in the dose of an eighth of a grain for these six weeks past, and has been freed of her fits of coughing; her cough has likewise considerably abated.

A man, sixty-four years old, has also been freed entirely of a cough of nearly six months standing, which had resisted the means generally used in similar cases, and even lozenges of ipecacuanha.

We have likewise prescribed emetin in doses of a quarter of a grain, and with success, taken every morning, in a case of whooping-cough of a child of six years. It has likewise been employed by us in small doses, for people of different ages and sexes affected with colds; the effects were at least as beneficial as those generally obtained from the use of ipecacuanha: we have remarked a narcotic effect, which ipecacuanha does not appear to produce.

The various phenomena we have enumerated were produced by emetin extracted either from the psychotria emetica, the calicocca ipecacuanha, or the viola emetica; which thus establishes the identity of the vomitive matter in these three plants, and confirms the results of our experiments. It likewise proves, that emetin possesses all the advantages without the bad effects of ipecacuanha; emetin has not the strong and nauseous smell of ipecacuanha, the taste of ipecacuanha is acrid and disagreeable, that of emetin is only a little bitter; the quantity of ipecacuanha necessary to produce vomiting in the same subject often varies; it depends not only upon the quantity of emetin this ipecacuanha contains, and this quantity differs not only in several roots designated under the

common and general name of ipecacuanha, but even in the mode of preparing the powder. We are obliged to carry the dose of ipecacuanha from 15 to 40 grains. When given in such large doses, its smell and taste are insupportable; portions of it adhere to the mouth, pharynx, and œsophagus; these are inconveniences so great to some persons, that they have an invincible dislike to it. Emetin dissolving in water, and operating powerfully, in doses of two or four grains at most, can never have these inconveniences; besides, its solubility in water renders it very apt to be absorbed in the intestinal canal, and thus produce more rapidly the general effects upon the system. Let me add to this, the advantage we possess of being able to annul its effects as soon as we wish, by the introduction into the stomach of a slight decoction of galls, as we have several times tried upon ourselves. We therefore judge, that, in the practice of medicine, it will, in most cases, be a preferable substitute to ipecacuanha.

We will draw the following conclusions from the facts and experiments related in the two divisions of this paper: 1st. That there resides in those species of ipecacuanha most frequently in use, the analysis of which we have made known, a peculiar substance that we have called *emetin;* to this is due the medicinal virtues of those plants. 2d. That this substance purges and vomits; it has a special action upon the lungs and mucous membrane of the intestinal tube; and further, that it possesses a marked narcotic power. 3d. That emetin may be used instead of ipecacuanha, in all cases wherein the latter is used; and the more readily, as this substance in a determinate dose, produces invariably the same effect, which is not the case with ipecacuanha of commerce; and from the very little taste, and scarcely any odour, its superior advantages as a medicine are striking.

*Steam Boats.*

THE very important benefits derived to the American public by the extension of steam boat navigation, renders every information respecting it of the highest interest. Much has been said in favour of, and against the use of high steam; and this very frequently by persons who were entirely ignorant of the subject. It is therefore with much satisfaction I introduce the following Report of the "Select Committee on Steam Boats," appointed by the British Parliament, to investigate the sources of accidents which occurred in some of the steam boats of that country. So many accounts are on record relative to accidents of a like nature in America, that I persuade myself the report will be productive of benefit in various points of view. I shall be gratified if the Medical Recorder may be made a vehicle for communicating useful information on this subject, by those whose knowledge of it enables them to give it a thorough investigation.—ED.

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"*Report from the Select Committee on Steam Boats.*

"The very clear, liberal, and enlightened Report of the Select Committee on *Steam Boats*, will be read with great pleasure by every person who can appreciate the anxiety of the legislature at once to watch over the public safety, and to render the discoveries of science available, in their highest extent, to the benefit of the community. The spirit, therefore, in which the committee entered upon and conducted their important labours, cannot be too highly applauded; and it is most satisfactory to find, that their investigations have led them to form a decided opinion, that the means of preventing future accidents, in the management of steam boats, are simple and easy. Those means are pointed out in the report; and the adoption of them will be rendered imperative on

the owners of all steam packets carrying passengers for hire, if the bill brought in by the chairman of the committee be ultimately adopted."—*Day and New Times.—London paper.*

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*Report.*

The Select Committee appointed to consider of the means of preventing the mischief of explosion from happening on board Steam Boats, to the danger or destruction of his Majesty's subjects on board such boats; and who were empowered to report their observations and opinion thereupon to the House; together with the minutes of the evidence taken before them; and to whom the petition of William Lester, Esq. was referred—have, pursuant to the Order of the House, considered the matters to them referred, and agreed to the following Report:

Your Committee entered on the task assigned them with a strong feeling of the inexpediency of legislative interference with the management of private concerns or property, farther than the public safety should demand, and more especially with the exertions of that mechanical skill and ingenuity, in which the artists of this country are so pre-eminent, by which the labour of man has been greatly abridged, the manufactures of the country carried to an unrivalled perfection, and its commerce extended over the whole world.

Among these, it is impossible for a moment to overlook the introduction of steam as a most powerful agent, of almost universal application, and of such utility, that, but for its assistance, a very large portion of the workmen employed in an extensive mineral district of this kingdom would be deprived of their subsistence.

A reference to the evidence taken before your Committee, will also show with what advantage this power has been lately applied, in Great Britain, to propel vessels both of burthen and passage; how much more extensively it has been used in America, and of

what farther application it is certainly capable, if it may not be said to be even now anticipated in prospect.

Such considerations have rendered your Committee still more averse, than when they entered on the enquiry, to propose to the House the adoption of any legislative measure, by which the science and ingenuity of our artists might even appear to be fettered or discouraged.

But they apprehend that a consideration of what is due to public safety, has on several occasions established the principle, that where that safety may be endangered by ignorance, avarice, or inattention, against which individuals are unable, either from the want of knowledge, or of the power to protect themselves, it becomes the duty of parliament to interpose.

In illustration of this principle, many instances might be given; the enactments respecting party-walls in building, the qualification of physicians, pilots, &c. the regulations respecting stage coaches, &c. seem all to be grounded upon it. And your Committee are of opinion, that its operation may, with at least equal propriety, be extended to the present case, on account of the disastrous consequences likely to ensue from the explosion of the boiler of a steam engine in a passage vessel; and that the causes by which such accidents have generally been produced, have neither been discoverable by the skill nor controlable by the power of the passengers, even where they have been open to observation.

Your Committee find it to be the universal opinion of all persons conversant in such subjects, that steam engines of some construction may be applied with perfect security, even to passage vessels; and they generally agree, though with some exceptions, that those called high pressure engines, may be safely used with the precaution of well constructed boilers, and properly adapted safety valves: and further, a great majority of opinions leans to boilers of wrought iron or metal, in preference to cast iron.

Your Committee, therefore, in consequence, have come to the following resolutions, which they propose to the consideration of the House:—

1. Resolved, That it appears to this Committee, from the evidence of several experienced engineers, examined before them,

that the explosion in the Steam Packet at Norwich was caused not only by the improper construction and materials of the boiler, but the safety valve connected with it having been overloaded; by which the expansive force of the steam was raised to a degree of pressure beyond that which the boiler was calculated to sustain.

2. Resolved, That it appears to this Committee, that in the instances of similar explosions, in steam packets, manufactories, and other works where steam engines were employed, these accidents were attributable to one or other of the causes above alluded to.

3. Resolved, That it is the opinion of this Committee, that, for the prevention of such accidents in future, the means are simple and easy, and not likely to be attended with any inconveniences to the proprietors of steam packets, nor with any such additional expense as can either be injurious to the owners, or tend to prevent the increase of such establishments. The means which your Committee would recommend are comprised in the following Regulations:—

That all steam packets carrying passengers for hire, should be registered at the port nearest to the place from or to which they proceed:

That all boilers belonging to the engines by which such vessels shall be worked, should be composed of wrought iron or copper:

That every boiler on board such steam packet should, previous to the packet being used for the conveyance of passengers, be submitted to the inspection of a skilful engineer, or other person conversant with the subject, who should ascertain, by trial, the strength of such boiler, and should certify his opinion of its sufficient strength, and of the security with which it might be employed to the extent proposed:

That every such boiler should be provided with two sufficient safety valves, one of which should be inaccessible to the engine man, and the other accessible both to him and to the persons on board the packet:

That the inspector shall examine such safety valves, and shall certify what is the pressure at which such safety valves shall open, which pressure shall not exceed one-third of that by which the boiler has been proved, nor one-sixth of that which, by calculation, it shall be reckoned able to sustain:

That a penalty should be inflicted on any person placing additional weight on either of the safety valves.

4. Resolved, That the chairman be directed to move the House, That leave be given to bring in a bill for enforcing such regulations as may be necessary for the better management of steam packets, and for the security of his Majesty's subjects, who may be passengers therein.

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*Minutes of Evidence.*

CHARLES HARVEY, Esq. in the Chair.

Mr. *Bryan Donkin* called in; and examined.

Were you desired to go down to Norwich, to inquire into the cause of the explosion of the steam boat?—I went down as a volunteer.

Did you see the steam boat?—No, we did not; it had been removed; we saw the boiler and part of the engine.

Of whom do you speak?—Mr. Timothy Bramah and Mr. Collinge accompanied me.

They were persons perfectly conversant with engines?—Yes.

You saw the boiler and the engine?—I did.

In your opinion, what was the cause of that explosion?—The immediate cause had been the use of steam of a very high expansive force; the proximate cause was the deficiency in the strength of the end of the boiler.

Of what was that boiler made, and what was its construction?—It was chiefly made of wrought iron, but partly of cast iron.

What part was wrought, and what part was cast?—The boiler was cylindrical; the cylindrical part and one end were wrought iron, and the other end was cast iron; it appeared to me to have

been previously of wrought iron; but, for what reason I do not know, the wrought iron end had been cut out, and a cast iron end substituted in its place.

Is it your opinion, that any boiler so constructed was unsafe?—As a high pressure boiler, certainly.

What do you call a high pressure?—I should call from 30 lbs. upwards high pressure; the technical phrase is applied to engines where the motive force is given by the expansive force of the steam.

Define what is the technical distinction between high pressure and low pressure engines?—When water is made to boil in the boiler, and confined so that the steam is not allowed to make its escape, it continues to acquire expansive force as it receives increase of heat; in the high pressure engine, the piston of the steam cylinder is forced down by the expansive force of the steam alone, against the resistance of the atmosphere; when the piston has arrived at the bottom of the cylinder, a valve is opened, and the steam is allowed to escape into the atmosphere, and the operation is reversed; the piston of the cylinder is made to ascend by the same kind of force. In the condensing engine, or the low pressure engines, the steam having been once permitted to fill the cylinder, a communication is then made between the cylinder in which the piston works and the vessel in which the steam is condensed: that is the distinguishing feature of the two engines. I will describe a further difference, which contingently arises out of the use of the two; that is, in the high pressure engines the engineer has it at his option to use what degree of expansive force he pleases, to convert an engine adapted for the power of five horses, or producing the power of five horses, to that of ten horses, or to any other extent which he may think his materials capable of sustaining. In the low pressure or condensing engines, the steam can never be advantageously employed above from two and a half to six lbs. upon a square inch.

Whatever power there is in what you call a high pressure engine, the pressure in that engine may increase the power beyond what it is calculated for, and by means of that may render it dangerous?—Certainly.

Is it your opinion, that a boiler could be made of proper materials, with safety valves, and under proper guard and direction, to make that high pressure perfectly safe?—That would depend upon the quantity of pressure to be used; a safety valve might be carried to three hundred, or to any assignable force. I think that a high pressure engine may be made safe to a certain extent; but, where they are left *ad libitum*, they never can be perfectly safe.

Do you mean to convey the idea, that it is impossible or difficult to adapt to a high pressure engine one or two safety valves joined with a mercurial gauge, acting at the same point of pressure, so as to make it equally safe with that upon any other construction?—In answer to the first part of the question, relative to the safety valve, I think I have answered that already; that we can apply a safety valve to any degree of pressure without any difficulty, but that the safety of the engine does not totally depend upon the safety valve.

State upon what other circumstances the safety of the engine depends?—My idea of the difficulty of obtaining a proper degree of strength at all times in the materials of which boilers may be made, arises from the constant deterioration which those boilers must be suffering from the action of the fire, and from the various degrees of expansion and contraction operating on different parts of the boiler.

Is it then your opinion, that in high pressure engines carried to that extent you mention, that danger would always operate?—It would not always operate, but it would be extremely liable to accidents.

In fact you yourself would not choose to use a high pressure engine, from the difficulty which exists, either more or less?—That is my opinion.

Have you made any calculation what would be the force required to be used to propel a boat in navigable rivers or canals?—This does not admit of a definitive answer. It depends entirely upon opinion, how far one force would be dangerous and another not; but if steam engines are employed for the purpose of propelling boats, that may be effected with perfect safety by the low

pressure or condensing engines, where the pressure need not exceed 6 lbs. to the inch.

Of course that must depend upon the resistance to be made, and the velocity required for the boat?—Then I must make choice of a more or less powerful engine; I think it just to state to the Committee, that there is an advantage to be derived from the use of high pressure engines on board boats, which are necessarily loaded differently at different times; this different loading requires a different power in the steam engine, and the high pressure engine is capable of having this additional power given to it without any difficulty, whereas in the low pressure engines they are confined to the force first assigned to them.

What is the maximum of the low pressure engines?—I scarcely ever saw them beyond 6 lbs.

In high pressure engines there is a great saving of fuel?—There is in one a peculiar kind of those called high pressure engines; there is a considerable saving of fuel in Woolf's engines; but in the common ones, I believe, there is but little saving.

If therefore the engines were to be used where the saving of fuel would be of considerable consequence, high pressure engines of a certain construction would be better adapted for that purpose than low pressure engines?—Where the saving was of much consequence.

If engines were to be used at sea, would it be of considerable consequence, the engine and the fuel being contained in a smaller compass?—Woolf's engine is not in a much smaller compass.

When you talk of the deterioration of the boiler, how long would a boiler, properly constructed and constantly used, be used with safety?—That is extremely uncertain; I have known one boiler worn out in six months, and another used for seven or fourteen years; the strength of cast iron boilers is extremely uncertain; cast iron contracts in various degrees in different places, and therefore is liable to break.

You think that all cast iron boilers are dangerous?—Certainly, when used for steam of high expansive force.

In your former answer, where you spoke of the extreme diffi-

culty of so regulating high pressure engines as to insure their safety, did you mean to speak of those which had cast iron boilers, or of both cast and wrought metal ones?—Chiefly as to the cast iron; it is more practicable to make a boiler of the malleable metals to resist a high pressure, as far as the tenacity of the metals is concerned; but another difficulty occurs, which prevents the application of the malleable metals to boilers for high pressure engines, which is that of rendering the joining of the plates secure.

Do you mean then to say, that wrought iron boilers are not in frequent use to high pressure engines, in point of fact?—I believe they are in much less frequent use than the cast iron boilers; and in Woolf's engine, they are scarcely used at all.

Is not the cast iron boiler much cheaper than the wrought?—I can scarcely tell that; I should think the cast iron would be cheaper, if made of equal strength.

In case of the explosion of a cast or a wrought iron boiler, which is attended with the greatest danger?—Cast iron, undoubtedly.

Why?—From the frangible nature of the metal.

What do you to apprehend to be the common effect, in case of the explosion of a cast iron boiler?—The metal is broken into fragments, and driven off with great violence in various directions.

What is the effect when a wrought iron boiler gives way?—Generally a rent; but I have seen one instance of a wrought iron boiler, where the whole of the upper part was rent from the bottom, driven through the house in which it was placed, and carried to a considerable distance; I believe several yards.

Do you apprehend, that, speaking generally, and unless by some extraordinary circumstance, such as the wilful shutting of the steam valve, there would be any reason to apprehend such an effect as you have just now mentioned, to arise from the renting of a wrought iron boiler?—No, I scarcely think it possible.

Supposing the boiler to be made of wrought iron, or copper rivetted, and safety valves properly adjusted, with a mercurial gauge also adapted in its diameter with due regard to the size of the boiler, do you conceive that any reasonable apprehension could arise respecting the safety of a high pressure engine?—I

think there might; but with less apprehension as to the extent of the destructive effect to be produced.

You speak of less apprehension as to the destructive effect; have the goodness to explain that.—On account that in the malleable metals a simple rending generally takes place, it would seldom happen that the upper part of the boiler would be torn off; but in the cast iron the fragments would be scattered about, and be more destructive.

Do you not know, that wrought iron boilers have been used to all sorts of steam engines for a considerable time past?—Yes.

Did you ever hear of any other than the single instance that you have mentioned, in which a wrought iron boiler burst in such a manner?—No.

Do you know what was the occasion of the top being blown off in the instance you mentioned?—We cannot tell what was the immediate reason, but I suspected it to arise from the shape of the boiler.

What was that shape?—The bottom was of the usual waggon shape boiler, convex inwards; the concave part of the boiler was over the fire, and those who examined it with myself imagined that the engine keeper had suffered the water to be expended, or the whole of it nearly evaporated, leaving a small portion of it in the lag of the boiler.

The boilers invented by Mr. Simms and Mr. Woolf were all of them cast iron?—I believe they were; I never knew them make any other.

Mr. Woolf's boiler has been in use nearly ten years?—I believe it has.

Did you ever hear of any accident happening to their boiler?—Yes, I have; I heard it stated the other day, by a brother-in-law of mine, Mr. Hall of Dartford, that he had known two or three accidents, but without any fatal or injurious effects.

How many engines of the high pressure character have been blown up?—I have heard of several.

Are there more than four?—A great many more, if there are taken into the account those which have exploded in America as well as here.

Do you consider low pressure boilers as safe from explosion in all instances?—Used with no further pressure than six pounds.

What renders them safe?—Because they never employ steam of high expansive force in them.

What are the means by which they are prevented from using steam of high expansive force in them?—Because it would be against the interest of the person using them to employ it.

Is there any other guard against the condensing engine receiving such a charge of expansive steam as will burst it, than the care of the engineer, or the interest of the owner?—Certainly none; because I have known instances where they have used in the same engine both steam of a high expansive force, and condensed it at the same time.

You have never heard of low pressure boilers blowing up?—No; I have never known of any explosion with injurious consequences; they give way repeatedly, but do no injury.

Is there any thing in low pressure boilers which may be depended upon absolutely, for preventing the steam acquiring an expansive force beyond what is intended?—Well regulated safety valves; mercurial gauges, or water gauges, will at all times secure it.

Do those means of limiting the expansive force in low pressure boilers continue perfectly efficacious under all circumstances of misconstruction and management?—That entirely depends upon the construction; I have known safety valves fail in their action from bad construction.

Can such or similar means be applied to high pressure boilers?—Yes, certainly.

Is not the feeding of low pressure boilers usually done by a column of water; and is not this column the great reason of their safety?—That is one reason, but they ought to have a safety valve besides.

Is it not the principal reason of their safety?—It is the most secure one.

If the feeding column of water be taken away, is not the security left to depend upon the safety valve?—Unquestionably.

Are low pressure boilers employed in boats always, or commonly fed by a column of water?—I never saw an instance of it.

If the mechanical means which are used to render the low pressure boilers secure succeed, will not the same means render high pressure boilers secure?—As far as the expansive force is not permitted to arrive beyond certain limits, so far it will afford security.

At what expansive force are low pressure boilers safe, according to their usual construction?—I have seen very few boilers constructed for the purpose of a low pressure engine, or a condensing engine that would sustain a pressure of ten pounds, without occasioning considerable leakage, or without forcing the joints.

Are they not very often used with a force to render them unsafe?—I never knew an instance of it.

Is not the explosion of them likely to do mischief?—Not under the pressure they are capable of sustaining.

Not even if they are made of cast iron?—Certainly.

Are they uniformly made of wrought iron?—No; several of them are made of cast iron.

Are not the greater number of them made of cast iron?—No; I apprehend not.

You cannot then state to the Committee how many instances of explosion you know of high pressure boilers?—No, I cannot.

Are they more than in low pressure boilers?—I never heard of an explosion in the low pressure boiler of any consequence whatever, merely a giving way of the plates or the wearing out of the boilers; not such a bursting as can be called an explosion.

May not every instance of explosion of the high pressure boilers with which you are acquainted, be traced to bad construction, or palpable mismanagement?—I have never examined many of them, and therefore what they may be immediately traced to I do not know; but all the explosions I have heard of have been occasioned by the use of steam of high expansive force; the one I visited at Norwich certainly arose from the defective construction of the boiler; it was extremely ill constructed.

Was it not as well from the palpable mismanagement of the engineer?—That I do not know; we were told that it was; I have no doubt there had been very great temerity and rashness.

Was not that high pressure boiler which blew up in London the

other day, at a sugar-house, entirely owing to the most palpable misconstruction?—I saw the boiler after it had burst; and I certainly should not have made a boiler in that shape, to have withstood the pressure which it was intended to bear.

Was not that boiler made of a different thickness; one side of it three quarters of an inch thick, and the other side two inches thick?—Those are very nearly the dimensions; but in addition to that, there was a defect in the casting, what we call a cold shut in the iron.

Is not the use of high pressure steam completely in its infancy?—Certainly, its introduction to general use is of much later date than the low pressure steam engines.

It is in fact to be considered as an invention of recent date?—It is.

Have not material improvements taken place in the construction and use of high pressure boilers, in consequence of the accidents which have happened?—I conceive Woolf's mode of constructing boilers to be a considerable improvement; a very material one, I have likewise been told, though I have never seen one, that Trevethick has invented; a method of making boilers by increasing their length and decreasing their diameter, so as to render them capable of sustaining pressure to a much greater degree than heretofore.

Have more accidents occurred since the invention of the high pressure boilers, than might have been expected from the invention of any new system whatever in the mechanical construction of engines?—Perhaps not.

What expansive force of steam is generally employed in those high pressure engines?—I fancy that is very variable, from 30 pounds to 120 upon the square inch, or even perhaps higher than that.

Instances have been known in which a boiler has been worked at 160 and 180; have there not?—I have heard of such things, but I never knew of them.

What is the proof to which high pressure boilers are generally exposed previous to their being used?—The most eligible proof they ought to be exposed to, is by water.

To what pressure?—I should think double the pressure to which they are intended afterwards to be subjected.

What is the estimated force, in your opinion, which would burst a high pressure boiler of the best construction?—That is very different, because it depends upon the strength and construction of the materials; I never entered into the calculation.

Have not the greatest advantages been derived to the mines and manufactures from the use of the high pressure boilers?—I believe inestimable advantages.

Have you any doubt that Cornwall has derived an advantage which may be considered as incalculable from them?—None in the world.

Do you think, from the few accidents which have occurred in the use of them, there is any better argument to be brought against the permitting them to be employed, than could be derived from the accidents which have arisen in the explosion of gun-powder in the clearing passages in the mines?—No, not as applied to the mines certainly.

You have mentioned that security is afforded to the engine by feeding the boiler by a column of water; from what does that security arise?—The pressure from the steam in the boiler could never rise to a force greater than that which would be equal to the pressure of the column of water; whenever it did arrive at that pressure, or beyond that pressure, the water would be blown out, and the steam would follow.

You have stated, that in the steam vessels used upon rivers, this precaution is not resorted to?—I never saw one, and it would be extremely inconvenient.

For what reason?—On account of the undulations the water would be subject to; it would be thrown out of the pipe from the motion of the vessel; and other inconveniences would arise, such as bringing the pipe through the deck of the vessel.

Do you apprehend, that a mercurial gauge would be exposed to the same inconveniences?—Certainly, I do; the altitude would be lessened by every new assumed position of the vessel; that is, if a tube placed vertically at first, should by the action of the vessel assume a diagonal or an oblique position, the altitude of the co-

lumn would be lessened, and its consequent pressure upon the steam lessened.

Are you of opinion that there would be much difficulty in guarding against such an inconvenience as that?—Yes, I think there would, generally speaking; but a well-constructed safety valve would answer all the purposes.

Are not the safety valves applied to the low pressure engines, even when the column of water is used to supply the boiler?—Most frequently they are; I have seen some without.

Did you never hear of the pressure in a condensing engine being raised by mismanagement as high as 19 or 20 lbs. per inch?—No; I do not recollect that I ever met with such a circumstance; I have no doubt that it has taken place.

If such a circumstance may take place with a low pressure engine, do you not think, that, according to the general calculation of the strength of their boilers to resist the usual pressure to which they are subjected, more danger would arise than in almost any case which could happen to a high pressure engine with a boiler properly adapted?—No, decidedly not; according to the general construction of low pressure boilers, they are so rivetted together to withstand the low pressure they are intended to bear, and they always give indications of an increase of pressure long before I should apprehend any danger from it; I mean by the joints giving way, and the steam forcing a passage through them.

Do you mean to apply that to the cast iron boilers?—No, certainly not; to the wrought iron or copper boilers.

The question before put was meant to apply to a low pressure engine, fitted up with a cast iron boiler?—As applied to the cast iron boiler, I should say, that being constructed to bear a less degree of expansive force, an explosion would sooner take place, and therefore would be less dangerous.

Less dangerous in comparison with what?—With a high pressure boiler.

Do you mean to say, that the explosion of the cast iron boiler of a low pressure engine, which should be burst by an improper degree of pressure, would be less dangerous than the rending of a wrought iron boiler, occasioned by a much higher degree of pressure?—I gave my answer as connected with the former ques-

tion, with regard to the liability to danger from low pressure boilers; I take for granted, that if a boiler is constructed to be applied to a low pressure engine, that a commensurate strength will be applied to the materials of the boiler, and that in the case of applying a boiler to a high pressure engine, an adequate strength must be used there to the pressure intended; therefore, if the low pressure boiler by any accident should be exploded, generally speaking, boilers made of the malleable metals must be much safer on an explosion taking place, at least they are not calculated to do so much mischief as the cast iron boilers.

Have you made any experiments, or are you acquainted accurately with the effect of such as have been made upon the different quantities of fuel consumed in the high and low pressure engines, in proportion to the quantity of power produced?—I have witnessed several experiments on Woolf's engines, where the object was to ascertain the comparative expenditure of coals or fuel in grinding corn between his engines and the low pressure or condensing engines, and the results were decidedly in favour of Mr. Woolf's engines.

You cannot speak as to the high pressure engines commonly in use?—I apprehend there is no saving of fuel, or very little; there may be a little.

What was the saving of fuel by Woolf's engine, as compared with the other?—The average effect in one case was the grinding eighteen bushels of wheat with one bushel of coals; the other average effect of Bolton and Watt's engine, or the low pressure engines, is the grinding of from ten to twelve bushels of wheat with a bushel of coals.

Do you know whether the power of the engines in lifting water, may fairly be reckoned at the same proportionable difference?—Yes; I believe they may. I do not speak from experiments; but I have no doubt as to the effect; by the reports from Cornwall, I am led to suppose it may be much greater.

Have you seen any account of the explosion of the steam engine on board a boat in America, within a few weeks past?—No; I have not. I understand there has been one.

From any information you received at Norwich, did you hear of any conduct of the manager of that boat, which occasioned

the explosion of the boiler?—No; the information I did receive upon that subject was since we returned to London.

*Seth Hunt*, Esq. called in, and examined.

Are you concerned with the province of Louisiana?—I have been in Louisiana; I formerly was commandant in Upper Louisiana.

Can you furnish the Committee with any information in respect of the safety of steam boats?—In the United States a great number of steam boats have been established:—The first was at New York; there are now running between New York and Albany, ten boats; two between New York and the state of Connecticut; four or five to New Jersey; besides the ferry boats that pass and repass across the river, of which there are four; those boats work all by low pressure engines; no accident has ever happened to any one of them; they have been running since the year 1807; and the boats at Albany perform about forty trips each per annum.

What distance is that?—An hundred and sixty miles. They go up in twenty-one hours, and come down in nineteen; sometimes a little longer, but never shorter than nineteen; that is the quickest passage.

At what rate per hour do they go?—Some of them go about seven miles an hour in still water; some boats have gone nine, ten, or eleven knots; but that is under particular circumstances. They have come from Newhaven to New York, ninety miles, in six hours and a half, without any sail.

Do they ever make use of a sail?—They have a sail and a mast which they can lower down and raise up to take advantage of a favourable wind, to assist them in their passage.

Those boats are upon the rivers?—Those which go to Albany pass the North River, and the others to Connecticut pass through what is called Long Island Sound, which is forty miles broad in one part of it. On the river Delaware there are a number of boats also established, which ply between Philadelphia and Trenton, in New Jersey; and Philadelphia and Bordenton, in New Jersey;

also others between Philadelphia and Newcastle, and Philadelphia and Wilmington; beside ferry-boats which pass and repass the Delaware. Several of those boats have low pressure engines, others have high pressure engines, working the high pressure engines from 100 to 140 pounds the square inch, and as high as 160; but those engines are constructed upon Oliver Evan's plan, called the Columbian plan.

Are they of wrought iron?—Yes; there are no cast iron boilers in America. I presume that may arise from their not having foundries in which they can cast them sufficiently large; they are all wrought iron boilers or copper; all which have to pass through salt water are copper. The boat Etna, which passes between Philadelphia and Wilmington, is a high pressure engine, and outstrips all the other boats; there is no competition at all between them. There are boats which pass also on the Chesapeake, which is there 40 miles wide; they pass from Baltimore to French Town and back, regular boats, two lines of boats; one leaves Baltimore one day, and the other the next; they pass every other day alternately. There are other boats from Baltimore, which go to Norfolk; there they pass a still wider part of the Chesapeake, which may be sixty miles wide; they have been to New London, which is still more exposed; and have been up to New Hertford.

Are those with high pressure engines?—No; low pressure. On the Potowmac there are also steam boats, and the James river, which pass between Richmond and Norfolk.

Have any accidents been known to arise on account of the heavy seas?—No; no accident whatever. I have not mentioned the most important circumstance connected with this:—the Powhattan steam boat was built at New York, went into the open ocean, encountered for three days a very severe gale of wind, arrived safe at Norfolk and up to Richmond. The gentleman is now in England who navigated her; and I heard him say, that he felt himself as safe as he should in a frigate; and he said there was this advantage, that the steam power enabled him, when they could not have borne sails, to put

the head of the vessel to sea, instead of lying in the trough of the sea, being exposed to be over-run by the waves.

What was her tonnage?—Two hundred and fifty tons.

What is the largest steam boat in America?—The largest I have seen are those on the Mississippi, the Etna and Vesuvius, which ply between New Orleans and Natchez: they are 450 tons, and they carry 280 tons merchandise, and 100 passengers; 700 bales of cotton besides the passengers, are transported to New Orleans.

Have you any regular allowance of power according to a ton? —I believe that after they have proved their boilers, which I presume should be done in all cases, if they wish to ascertain the pressure, they work with safety at half that which it has been proved at.

Is there any rule according to tonnage established as an usage? —I am not an engineer, and am not conversant with that subject; I have passed through the country, and have been on board most of those boats, but I am not acquainted with that fact.

Have any accidents happened?—Within my recollection only three accidents have happened to steam boats in America; the first happened on the Ohio, and was occasioned, as stated by the public papers, by the negligence and inattention of the engineer, who loaded the safety valve, and neglected to attend the fire; all hands were engaged in hoisting the anchor, the fire was in a very high state, and of course produced a vast deal of steam that did not escape by the ordinary operation of the engine, which would discharge it and carry it off.

What is called the safety valve had been improperly loaded and neglected?—Yes, but that never need happen; the principle of steel-yards is to put a weight at the end, and if you put no more than that, it will answer its purpose;—so with a steam engine; it may be overloaded, and its effect destroyed. The next accident happened, not from a fault of any body, but from an act of God; it was lightning, as was satisfactorily explained to the public, both by the passengers and those interested in the boat; that was at Charleston in South Carolina; the pipe which carries the smoke

up to the top attracted the lightning, and it went down and split the boiler.

It was not considered as at all connected with the operation of the engine?—No, not at all through negligence; a third accident happened lately to the Powhattan; she was not in operation when it happened; they were out of fuel, they stopped their boat, and lay still upon the water while they went after wood; still, however, they kept up their fire, and the steam was high, and it exploded in that situation, there being no consumption of the steam as it accumulated. Those are the only accidents that ever happened, except such as have happened from vessels taking fire.

Were those vessels high or low pressure engines?—All low pressure engines. No accident has ever happened in America to a high pressure engine, either in a manufactory or out of it; and there are many engines used in the manufactories, and in flour-mills and saw-mills, constructed upon the plan of Oliver Evans, which act on the high pressure principle to 150 pounds an inch; he has worked 160, but 120 is his constant average. There is not an old woman in America that is ever frightened at all at a high pressure engine, any more than they now are at cannon. There is a very large engine, about forty-five horse power, at Cincinnati, on the Ohio river, which moves seven pair of stones in a flour-mill, a woollen manufactory, and a cotton manufactory seven stories high; it works upon the high pressure, and there are saw-mills and grist-mills at various places.

What is the fuel?—Wood in most places. At Pittsburgh and on the Ohio river, it is coal and wood; at Pittsburgh and at Weeling, and a hundred other places, there is fifty miles square a solid mass of coal; they drive the shaft horizontally into the hill, and the coal is abundant, their head in the mountains, as fine coal as any in the world; it is delivered at the houses of the inhabitants at sixteen bushels for a dollar.

Is the number of steam boats now increasing in America?—Very rapidly.

Are those that are now constructing upon the high or the low pressure system?—Upon both, because there are different interests and different companies. Mr. Evans being a patentee, they have

give something for the use of his patent; if they cannot make their bargain with him, they use the low pressure engine; but there is a new engine invented in America, a perfectly rotatory engine, built for one-third of the money, which is now coming into use in several of the steam boats; and it was supposed when I came away it would supersede all other engines.

Do you know of any particular guard in the construction of steam engines used in America, to prevent accidents?—I know of no other than that of properly constructing the safety valve, and the manner of loading it, so that they cannot get on more than a certain weight; they must, of course, construct them strong enough, and prove them.

They are under no government regulation?—They are not.

Does that with a rotatory motion consume more coals?—It is supposed to consume less; twelve bushels of coals with the rotatory motion will perform the same work as the other engine with twenty.

Mr. *T. Bramah*, called in, and examined.

You are an engineer, at Pimlico?—I am.

You were one of the gentlemen that went to Norwich to inquire into the explosion of the steam boat?—I was.

Did you go at the request of any party, or of your own voluntary suggestion?—I went in consequence of my friends, Mr. Collinge and Mr. Donkin, calling upon me to ask my opinion, whether it would be right for us to interfere upon such an occasion; I concurred with them that it would, and volunteered to go.

Your design was to inquire into the causes of the explosion?—Yes, and to examine as much of the wreck as we could find.

State to the Committee to what you attribute the accident.—The observations I made led me to determine it was owing to the expansive force of the steam, and the inadequacy of the boiler to sustain that force.

Was it a high pressure or a low pressure engine?—A high pressure engine; the boiler was badly constructed and shaped.

Of what materials was the boiler composed?—Of wrought and cast iron, and it was the cast iron part that gave way.

Those two materials expand in a different proportion with the same degree of heat?—Yes, they do.

Is it usual to have the boiler of wrought and cast iron?—I should think it would be avoided on all occasions by experienced engineers: but I have often seen it.

This engine was not made so at first, but altered afterwards; was it not?—Yes, in consequence of the other giving way.

Have you any reason to suppose that the accident might be attributed to negligence or mismanagement in the director of it?—We had verbal testimony, from which I had no doubt the steam was at a considerable degree of pressure; but the end was very improperly made.

Did you ever learn at what rate the man was working?—No, I understood he was working at 60 lbs. an inch generally, probably it might be 120 at that moment; but I should think it not equal to the working of 60, for it was only three-fourths of an inch and a sixteenth in some places in thickness, and it was four feet in diameter at the end: it was a flat end to the cylinder like a drum.

Is it possible to construct the engines in steam boats in such a manner that there is great improbability of any accident happening?—I do not know how to answer as to their being perfectly safe; I do not feel that materials, when they are submitted to so great a pressure, are safe, for we find that very few materials will stand a great degree of pressure for any length of time; we often find that a water press, which has been efficient six or seven years together, at length gives way, when the metals are subjected to a very great pressure; it is like a blow with a heavy machine for breaking metals, which does not break the first time, but is constantly tending to loosen the particles.

Do you think that a high pressure engine, under any guard that can be applied to it, is a safe engine to use in a steam boat?—I do not conceive it is a proper engine, or a safe one.

Did you ever hear of their having been used with wrought iron boilers with perfect safety?—No, I have not heard of any compa-

rative statement of either the wrought or cast; I know they are usually made with cast.

Do you consider yourself sufficiently an engineer, with respect to the construction of steam engines, to be able to give, of your own knowledge, a decided answer to such questions?—Yes, I do conceive so; I have paid a great deal of attention to the subject of steam engines, and I believe I know the principle of every one in existence.

If on a certain pressure in a high pressure engine, a safety valve or safety valves were so constructed, as that they would open and discharge the steam with a pressure much less than the boiler was calculated for, would not such a boiler be perfectly safe, admitting it to be made of proper materials, and properly constructed?—Yes, if it could be proved that the boiler was calculated to resist a pressure much greater than that to which it was to be subjected in the ordinary way of business, and that proper safety valves were applied, it would be safe as long as the action of those safety valves was insured, and so long as the perfection of the metal could be upheld.

If a boiler was found to sustain the pressure of 100 lbs. to a square inch, and such boiler had been tried, and it was found, before used, that it would bear a pressure of 200 lbs. upon the inch, would not such a boiler be perfectly safe to be used, if the safety valve was so constructed as to open itself at the pressure of 60?—I cannot pronounce it perfectly safe, and I must give this reason; I think if a boiler was prepared to sustain 100 lbs. and strained to 200, it might afterwards perhaps burst at 40, the straining having injured it.

In the situation of steam boats, might not the unskilfulness of the sort of persons who manage them render any steam boat unsafe?—I do not know how that could be the case; they might by wilful perversion of the proper principle of management render them unsafe to a comparative extent; for instance, if there was half the pressure, there would be but half the danger under like circumstances.

Do you or not apprehend, that a boiler, upon a proper construction, of wrought metal, may be tried with a certain force, so small

in comparison with that pressure which it is intended to bear, as not to incur any risk of being injured in the proof, and have a complete surplus of strength, so as to enable it to be afterwards used without any danger in the use?—I should pronounce such a boiler to be perfectly safe, and, so long as it maintained those properties, it would continue so.

Have you considered how safety valves may be constructed as adapted to boilers, so as to put it out of the power of the person having the management of them improperly to load them, or to alter their nature?—The most simple mode which has suggested itself to me is, to have a double safety valve, and to lock one up, and to have it examined once a week, or as often as may be necessary, to see that its action is perfect.

If there were those two safety valves, one under the management of the person who had the direction of the boat, and the other safety valve under such guard that he could not prevent its action; such a boiler would, in your opinion, be safe?—That would be more safe than any I have ever seen.

Have you ever witnessed the different effects of the explosion in cast and wrought iron boilers?—No; I have seen wrought iron vessels that have been burst—torn out, as it were.

Did you never see a cast iron vessel burst?—Yes, many; the wrought iron generally tears and opens out, to admit of the fluid escaping; it is generally the fluid which does the mischief when the wrought iron is used, and it is both the fluid and the material which does the mischief when the cast iron bursts; the effect in cast metal is, to carry the pieces of the metal to a considerable distance, which is seldom the case in the wrought, unless where there is any cold-shut in the metal; the cast bursts like a shell, projecting the particles of the metal to a considerable distance.

If an accident of that nature happens to a wrought iron boiler, the mischief would probably be confined to the room in which the boiler was placed?—No, I do not conceive that to be the case; I have no doubt, if it had been a wrought iron boiler in this case, the deck of the vessel would have been blown off; the pressure would have been in all places alike, but here it was only in a lateral direction, and the end of the boiler was blown into the river,

and by its re-action the boiler itself was thrown into the river on the other side.

You have said, that you have frequently seen wrought iron vessels burst?—Not frequently in our own experience; I have seen copper frequently that has burst.

Have any fatal or serious accidents happened on those occasions?—I have heard of some, but have not witnessed one; the accidents I have observed have chiefly arisen where cast iron boilers have been used.

In the first instance, when wrought iron boilers are used, the injury is sustained by individuals by the fluid escaping?—Yes.

Where cast iron boilers have been used, it has been by the explosion of metal?—Yes; I do not mean to say it may not be by the explosion of wrought iron boilers; it is very difficult to obtain a boiler of perfect metal; and if there are any cold-shuts, or other defects in it, it may explode in the same way.

Is copper subject to the same evils?—No; I think it is generally in a purer state; iron is very impure at the best.

Mr. *John Taylor* called in, and examined.

What is your profession?—My principal pursuit is that of a manufacturing chemist, at Stratford in Essex; but I have the control of a district of copper mines near Tavistock.

Have those engagements made you perfectly conversant with the nature and application of steam engines?—I have attended to that subject to a certain extent; of late my attention has been called to high pressure steam particularly, being concerned with my brother in a patent for applying high pressure steam to the boiling of liquids, and using it extensively in our own manufactory, both in steam engines and for the purpose of boiling.

Are you acquainted with the accident which lately happened to the steam boat at Norwich?—By report only.

What do you know of that transaction?—I have heard that the plate of cast iron was of an inadequate thickness for the strain to be put upon it. With respect to the impropriety of cast iron compared with wrought, we ourselves constructed one of the first high pressure boilers we used, precisely in the same manner

with that on board the Norwich boat; the boiler was proved to 100 lbs. a square inch, by the water proof, commonly used with about 40 lbs. pressure, but the cast iron end broke one day with less than 20 lbs. pressure of steam; the fracture being caused evidently by the heat expanding the cast iron end unequally, and being kept from going to the form it would otherwise assume.

Then you are of opinion it would be improper to make one of such a construction?—As far as I at present know, I should say it was. Upon that we altered our boilers, all having been since made of wrought iron only. I have seen most of the high pressure boilers which have been made, except Woolf's. I have seen Trevethick's old construction, which were cast iron; his new construction with his wrought iron tubes. The Wells-street boiler, which blew up, I saw immediately after its destruction; I was surprised to see that it had been made of cast iron, a pan of eight feet diameter therefore extending the bursting surface in the proportion of four to sixteen; it was of unequal thickness, badly cast, cast from small furnaces, and the contact of the iron not complete; it did not meet in fusion.

Was that a high pressure boiler?—Yes, intended to boil sugar; the thickness intended to be, doubtless, about two inches or two inches and a quarter; but, by inserting the core unequally, the thickness on one side was three quarters of an inch, on the other side the thickness of the metal was two inches and a quarter, or thereabouts; therefore, to the general objections to cast iron, was added a most improper construction. I understand from the men who were working there, (Frenchmen,) that there had been something like a mercurial gauge attached to it, but that the mercury never fluctuated; it indicated nothing; that the safety valve was loaded down with weights, which we could not collect, and therefore did not ascertain the pressure; but that it was probable there was a pressure of more than 100 lbs. per inch.

Had you ever seen it worked before?—No, nobody was admitted to see it worked.

*(To be continued.)*

THE following remarks are of a nature too important to be confined to the columns of a newspaper. Although I am not prepared to give a full assent to all the positions therein laid down, without further confirmation from other sources, and longer continued observations; yet I consider them as well deserving the attentive consideration of every medical man, who has made, or shall make, the epidemics of our country an object of his pursuits.—ED.

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## *On the Temperature of the Summers which are adapted to give activity to the infection or seeds of the Yellow Fever, in the city of Philadelphia.*

(From the American Daily Advertiser.)

On the first day of August, 1809, there was published in the American Daily Advertiser, and, on the same day, or within a few days after, in most of the other daily papers of this city, an account, which I had prepared, of the state of Fahrenheit's thermometer taken in the shade at 3 P. M. during seventeen summers, 1793 to 1809, both inclusive. I shall now republish that account, and subjoin a state of the same instrument from 1810 to 1817, so as to comprehend in all twenty-five summers, 1793 to 1817. The intent of this publication is to exhibit to public view the mean heat at 3 P. M. of each and every of those summer months, and to draw an inference from thence, that the *Yellow Fever*, being a native of hot climates, cannot probably prevail to any alarming extent here in any season, except the mean heat of the thermometer at that hour, during the summer, and especially during the two whole months of June and July, shall be as high as seventy-nine degrees—if cooler, it will not spread, although some passengers and their clothing and bedding may arrive here, bringing the disease or the infection with them; but in hotter seasons it has prevailed, and probably will again prevail more or less, and very much in proportion to the heat of the season.

This is not an enquiry prompted by idle curiosity, but an attempt to establish a knowledge very important in its consequences, not only to all our citizens concerned in naval or mercantile business, but to the whole population of this city and liberties; because, if well founded, as I believe it to be, it will serve as a rule to point out to every citizen when there is, or is not, danger to be apprehended; when it may be necessary, or not, to provide retreats in the country. If well understood and established to be a truth founded in experience, it may also tend to disembarrass the trade of this port, in some years, from detentions and quarantines when they are useless.

By the following account of the mean heat at 3 P. M. of each month in the last twenty-five summers, it will appear evidently that the *Yellow Fever* has never within that period prevailed here at all, or so as to occasion alarm, when the mean heat at that hour of all June and July had been lower than 79°, only a very little in 1802; and that in every summer when it has been above 79°, it has prevailed more or less, and the mortality has been regulated very much by the heat being higher or lower. In 1793 and 1798, which were the hottest summers in all the twenty-five years, it prevailed most, and was attended by the most extreme mortality. In 1797, 1799, 1803, and 1805, when lower degrees of heat prevailed, the mortality was less. In all the other years, (except a small mortality in 1802,) when the mean heat of those two months was below 79° at the hour mentioned, we have had no alarm of *Yellow Fever.*

I consider the two months of June and July as governing the summer season, insomuch that by the first day of August in any year, we may be pretty certain whether we shall be afflicted with *Yellow Fever* that year, or not; so that if we find the mean heat of the thermometer at 3 P. M. placed properly in the shade, in a free current of air, at least 20 or 30 feet from any sunshine, and not exposed to the reflected heat of any building, to be below 79°, we may rest easy, and conclude that we are not likely to be visited with that scourge during the summer or autumn then passing over our heads.

In 1793 the mean heat of June and July at 3 P. M. was 82°—

in 1798 it was 80° 6, both of which indicated the calamity that followed; but August, 1798, was so extremely hot, that it heightened the mortality, and made it nearly equal to what it was in 1793, when the two first summer months were hotter, but August not so hot as in 1798. The wetness or dryness of the summer may also have an effect, not yet well ascertained; it being remarkable that in 1805, when the mean heat of all June and July was 79° and August 81° 7, the two months of July and August were so very dry, that perhaps not so much as one quarter of an inch in depth of rain fell till within 3 or 4 days of the end of the latter month, when it rained moderately; this rain appeared to be sufficient, coming after the preceding heat, to give activity to the dormant infection of the *Yellow Fever*, which immediately afterwards broke out, more especially in Southwark, where it was very mortal in all September. The use of the Schuylkill water, which is said to be much purer than the old pump water, may have had a beneficial effect by way of prevention within the last ten or twelve years; so may the regulations and care of the different boards of health, which to a certain degree should never be intermitted: still I am of opinion that the heat, not of a few days or weeks, but the mean heat of the summer season, is the grand governing cause, under Providence, that excites or depresses this alarming and dreadful scourge when it appears in our city.

Here follows the state of the Thermometer in each month of those twenty-five summers as above referred to.

| YEAR. | Mean Heat of June at 3 P. M. | Mean Heat of July at 3 P. M. | Average of the two months of June & July at 3 P. M. | Mean Heat of August at 3 P. M. | Mean Heat of the whole three Summer months at 3 P. M. | REMARKS. |
|---|---|---|---|---|---|---|
| **1793 | 79 7 | 84 3 | 82 | 82 7 | 82 2 | Great mortality of yellow fever in Philadelphia—4000 died in August, September, and October. |
| 1794 | 75 6 | 80 4 | 78 | 81 7 | 79 2 | No alarm of yellow fever here. |
| 1795 | 75 | 82 2 | 78 6 | 80 3 | 79 3 | Ditto—fever in New York and Norfolk. |
| 1796 | 76 5 | 81 5 | 79 | 80 3 | 79 4 | No alarm here. |
| *1797 | 79 | 84 2 | 81 6 | 79 | 80 7 | Yellow Fever here—1250 died in three months. |
| **1798 | 77 | 82 | 79 5 | 86 5 | 81 8 | Great yellow fever here—3500 died in three months. |
| *1799 | 77 | 84 | 80 5 | 82 | 81 | Yellow fever here—1000 died in three months. |
| 1800 | 75 | 78 | 76 5 | 78 | 77 | No alarm here—fever in Baltimore. |
| 1801 | 76 | 80 | 78 | 77 | 77 7 | No alarm here. |
| *1802 | 75 7 | 78 | 76 3 | 78 | 77 2 | Yellow fever spread a little—perhaps 200 adults died of it. |
| *1803 | 76 9 | 81 8 | 79 3 | 79 4 | 79 3 | Yellow fever here—slightly. |
| 1804 | ?1 | 78 | 74 5 | 75 | 74 7 | No alarm here. |
| *1805 | 75 | 83 | 79 | 81 | 79 7 | Yellow fever began about the 1st of Sept. was very mortal in Southwark and little out of it. |
| 1806 | 78 1 | 78 7 | 78 4 | 72 1 | 76 3 | |
| 1807 | 71 6 | 77 9 | 74 7 | 75 2 | 74 9 | |
| 1808 | 75 5 | 78 8 | 77 1 | 76 5 | 76 9 | |
| 1809 | 73 7 | 75 1 | 74 4 | 76 7 | 75 1 | |
| 1810 | 74 2 | 75 4 | 74 8 | 75 4 | 75 | All these twelve years were cooler than 79°, on a mean of all June and July at 3 P. M. and there was no alarm of yellow fever in Philadelphia, in any one of them, I believe, or none that spread and continued. |
| 1811 | 74 4 | 80 1 | 77 2 | 75 3 | 76 6 | |
| 1812 | 73 8 | 77 4 | 75 6 | 74 2 | 75 1 | |
| 1813 | 75 3 | 76 7 | 76 | 77 3 | 76 4 | |
| 1814 | 70 1 | 73 2 | 72 6 | 76 7 | 74 | |
| 1815 | 74 2 | 81 8 | 78 | 77 3 | 77 7 | |
| 1816 | 72 5 | 73 5 | 73 | 76 5 | 74 1 | |
| 1817 | 73 2 | 78 | 75 6 | 77 3 | 76 3 | |

NOTE.—The *Yellow Fever* years are marked with an Asterism.

The state of the thermometer as above noted has been taken, 1793 to 1799, from the observations of David Rittenhouse, Esq. deceased, or some of his family, made at his place of residence, corner of Delaware Seventh and Mulberry streets; for the next fifteen years chiefly by Dr. Samuel Duffield, deceased, in Chesnut

near Front street, in a northern exposure, and since by myself in Delaware Eighth street, with an easterly exposure—all I believe tolerably correct.—Any man may keep such an account for himself, and a thermometer of the price of five or six dollars will answer the same purpose as a more expensive instrument.

*Sept.* 9, 1817. C. E.

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## *Meteorological Observations.* 1817. *September.*

(Taken at the Philadelphia Dispensary in Fifth-street. The Thermometer in the entry of the building.)

| Date. | Thermometer. | | Barometer. | | Wind. | | Weather. | |
|---|---|---|---|---|---|---|---|---|
| | 8 A. M. | 3 P. M. | 8 A. M. | 3 P. M. | 8 A. M. | 3 P. M. | 8 A. M. | 3 P. M. |
| Sept. 1 | | | | | | | | |
| 2 | 68 | | 29.8 | | E. | N. | Clear. | |
| 3 | 68 | 81 | 27.8 | 29.7 | E. | S. W. | Fair. | |
| 4 | 71 | 80 | 29.7 | 29.7 | S. W. | S. W. | | |
| 5 | 72 | 83 | 29.7 | 29.7 | S. | S. W. | | |
| 6 | 69 | 78 | 29.9 | 29.8 | N. | | | |
| 7 | | | | | | | | |
| 8 | 66 | 73 | 30. | 30. | | | | |
| 9 | 69 | 77 | 29.9 | 29.8 | S. E. | S. | Clear. | |
| 10 | 72 | | 29.8 | | S. W. | | | |
| 11 | 74 | 84 | 29.8 | 29.7 | S. | S. W. | | |
| 12 | 75 | 81 | 29.7 | 29.7 | S. | N. | | |
| 13 | 69 | 73 | 29.8 | 30. | N. E. | N. E. | | |
| 14 | | | | | | | | |
| 15 | 55 | 61 | 29.9 | 29.8 | N. E. | N. E. | Rain. | |
| 16 | 59 | 68 | 29 6 | 29.6 | N. W. | N. W. | Cloudy. | |
| 17 | 63 | | 29.7 | | N. W. | | Clear. | |
| 18 | 68 | 73 | 29.6 | 29.8 | W. | N. W. | Clear. | |
| 19 | 61 | 72 | 30. | 30. | N. W. | N. E. | Clear. | Clear. |
| 20 | 64 | 75 | 30. | 30. | N. E. | S. W. | Clear. | Clear. |
| 21 | | | | | | | | |
| 22 | 62 | | 29.9 | | E. | | | |
| 23 | 68 | 72 | 29.5 | 29.5 | S. W. | S. W. | Cloudy. | Rain. |
| 24 | 65 | 67 | 29.4 | 29.5 | W. | S. W. | Rain. | Fair. |
| 25 | 56 | 63 | 29.6 | 29.6 | N. W. | S. W. | Cloudy. | Fair. |
| 26 | 56 | 66 | 29.6 | 29.5 | S. W. | S. W. | Clear. | Clear. |
| 27 | 60 | | 29.5 | | S. W. | | Clear. | |
| 28 | | | | | | | | |
| 29 | 52 | 62 | 29.9 | 29.9 | W. | W. | Clear. | Clear. |
| 30 | 55 | 60 | 29.8 | 29.7 | W. | N. W. | | |

*Meteorological Observations.* 1817. *October.*

| Date. | Thermometer | | Barometer. | | Wind. | | Weather. | |
|---|---|---|---|---|---|---|---|---|
| | 8 A. M. | 3 P. M | 8 A. M. | 3 P. M. | 8 A. M. | 3 P. M. | 8 A. M. | 3 P. M. |
| Oct. 1 | 50 | 56 | 29.8 | 29.7 | N. E. | N. E. | Rain. | Clear. |
| 2 | 47 | 57 | 29.8 | 29.8 | N. E. | N. E. | Cloudy. | Cloudy. |
| 3 | 52 | 57 | 29.7 | 29.7 | N. E. | N. E. | Cloudy. | Cloudy. |
| 4 | 56 | 66 | 29.8 | 29.8 | N. E. | W. | Clear. | Clear. |
| 5 | | | | | | | | |
| 6 | 60 | 66 | 29.6 | 29.6 | S. W. | S. W. | | Cloudy. |
| 7 | 66 | 60 | 29.2 | 29.2 | S. | S. W. | | |
| 8 | 53 | 63 | 29.7 | 29.7 | S. W. | W. | Clear. | Clear. |
| 9 | 53 | 67 | 29.8 | 29.7 | W. | S. W. | Clear. | Cloudy. |
| 10 | 49 | 59 | 29.9 | 29.8 | N. W. | W. | Clear. | Clear. |
| 11 | 49 | 60 | 29.9 | 29.8 | N. W. | S. W. | Clear. | Clear. |
| 12 | | | | | | | | |
| 13 | 60 | | 29.5 | | S. W. | | Clear. | |
| 14 | 54 | 55 | 29.7 | 29.7 | N. W. | N. | Rain. | Clear. |
| 15 | 50 | 56 | 29.8 | 29.7 | N. | N. | Clear. | Cloudy. |
| 16 | 49 | 46 | 29.7 | 29.6 | N. | N. W. | Cloudy. | Cloudy. |
| 17 | 42 | 50 | 29.7 | 29.6 | N. W. | S. W. | Clear. | Clear. |
| 18 | 48 | 57 | 29.4 | 29.5 | S. W. | N. W. | Cloudy. | Clear. |
| 19 | | | | | | | | |
| 20 | 50 | 57 | 29.8 | 29.9 | N. W. | N. W. | Clear. | Clear. |
| 21 | 43 | 59 | 30.1 | 30. | N. W. | S. W. | Clear. | Clear. |
| 22 | 51 | 64 | 30. | 29.9 | S. W. | S. W. | Cloudy. | Clear. |
| 23 | 54 | 68 | 29.9 | 29.8 | S. W. | S. E. | Cloudy. | |
| 24 | 50 | 68 | 29.8 | 29.6 | S. E. | E. | Cloudy. | Clear. |
| 25 | 62 | 53 | 29.4 | 29.7 | S. E. | N. E. | Cloudy. | Cloudy. |
| 26 | | | | | | | | |
| 27 | 55 | 59 | 29.7 | 29.5 | N. E. | S. | Cloudy. | Cloudy. |
| 28 | 50 | | 29.8 | | N. W. | | | |
| 29 | 40 | 47 | 30.1 | 30.2 | N. W. | N. E. | Clear. | Clear. |
| 30 | 39 | 52 | 30.3 | 30.2 | N. E. | N. E. | Clear. | Cloudy. |
| 31 | 47 | | 30.2 | | N. E. | | Cloudy. | |

*Meteorological Observations.* 1817. *November.*

| Date. | Thermometer. | | Barometer. | | Wind. | | Weather. | |
|---|---|---|---|---|---|---|---|---|
| | 8 A. M. | 3 P. M. | 8 A. M. | 3 P. M. | 8 A. M. | 3 P. M. | 8 A. M. | 3 P. M. |
| Nov. 1 | 53 | 55 | 29.6 | 29.4 | N. E. | N. E. | Rain. | Rain. |
| 2 | | | | | | | | |
| 3 | 46 | 54 | 29.6 | 29 6 | N. W. | N. W. | Clear. | |
| 4 | 40 | 54 | 29.8 | 29.8 | N. E. | W. | Clear. | Clear. |
| 5 | 41 | 53 | 30. | 30. | N. | N. | Clear. | Clear. |
| 6 | 40 | 55 | 29.9 | 29.8 | S. E. | S. W. | | Cloudy. |
| 7 | 52 | | 29.9 | | S. | | Clear. | |
| 8 | 52 | 64 | 30. | 29.9 | S. E. | E. | Cloudy. | Cloudy. |
| 9 | 62 | 70 | 29.8 | 29.9 | S. E. | S. W. | Cloudy. | Clear. |
| 10 | | 67 | | 29.8 | S. | | Cloudy. | |
| 11 | | | | | | | | |
| 12 | | 73 | | 29.4 | S. | | Clear. | |
| 13 | 48 | 56 | 29.9 | 29.9 | N. W. | N. W. | Clear. | Clear. |
| 14 | 42 | 52 | 30. | 30. | N. W. | N. | Clear. | Cloudy. |
| 15 | 51 | 61 | 29.7 | 29.5 | N. | S. | Rain. | Cloudy. |
| 16 | | | | | | | | |
| 17 | 40 | | 29.8 | | N. E. | | Rain. | |
| 18 | 50 | 48 | 29.4 | 29.3 | N. E. | N. W. | Rain. | Cloudy. |
| 19 | 40 | 45 | 29.8 | 29.9 | W. | W. | Clear. | Clear. |
| 20 | 35 | 43 | 30. | 30. | S. W. | S. W. | Clear. | Clear. |
| 21 | 43 | 42 | 29.9 | 29.9 | N. W. | N. W. | Cloudy. | Cloudy. |
| 22 | 37 | 47 | 29.8 | 29.7 | N. W. | N. W. | Cloudy. | Cloudy. |
| 23 | | | | | | | | |
| 24 | 33 | 40 | 30. | 30. | N. W. | N. W. | | Clear. |
| 25 | 31 | 44 | 30. | 29.8 | N. W. | S. W. | Clear. | Clear. |
| 26 | 38 | 47 | 29.8 | 29.9 | N. W. | N. | Cloudy. | Clear. |
| 27 | 33 | | 30. | | N. | | Fair. | |
| 28 | 36 | 50 | 29.9 | 29.8 | S. W. | S. W. | | Clear. |
| 29 | 37 | | 29.8 | | S. W. | | | |
| 30 | | | | | | | | |

## *Meteorological Observations.* 1817. *December.*

| Date. | Thermometer | | Barometer. | | Wind. | | Weather. | |
|---|---|---|---|---|---|---|---|---|
| | 8 A. M. | 3 P. M. | 8 A. M. | 3 P. M. | 8 A. M. | 3 P. M. | 8 A. M. | 3 P. M. |
| Dec. 1 | | 29 | 29.6 | | | | Clear. | |
| 2 | 51 | 54 | 29.3 | 29.1 | S. | | Cloudy. | |
| 3 | 36 | 38 | 29.4 | 29.4 | S. W. | S. W. | Cloudy. | Cloudy. |
| 4 | 25 | | 29.6 | | S. W. | | Clear. | |
| 5 | 25 | 34 | 29.7 | 29.8 | S. W. | W. | Clear. | Clear. |
| 6 | 30 | 34 | 30. | 30. | W. | | | Clear. |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | 34 | 47 | 29.7 | 29.6 | W. | W. | Cloudy. | Clear. |
| 10 | 41 | 48 | 29.6 | 29.6 | W. | W. | Cloudy. | Clear. |
| 11 | 42 | 44 | 29.8 | 29.8 | N. E. | N. E. | Cloudy. | Cloudy. |
| 12 | 41 | 49 | 29.7 | 29.5 | N. W. | N. E. | Cloudy. | Cloudy. |
| 13 | 46 | | 29.8 | | N. | | Cloudy. | |
| 14 | | | | | | | | |
| 15 | 48 | 40 | 29.2 | 29.2 | N. W. | W. | Rain. | Cloudy. |
| 16 | 28 | 33 | 29.7 | 29.7 | W. | S. W. | Cloudy. | |
| 17 | 32 | 40 | 29.7 | 29.8 | N. E. | N. W. | Cloudy. | Clear. |
| 18 | 33 | 39 | 29.9 | 29.7 | N. W. | N. E. | Cloudy. | |
| 19 | 37 | 37 | 29.6 | 29.6 | N. W. | W. | Clear. | Cloudy. |
| 20 | 29 | 28 | 29.6 | 29.6 | W. | N. W. | Clear. | Cloudy. |
| 21 | | | | | | | | |
| 22 | 20* | 29 | 30.1 | 30.2 | S. W. | W. | Clear. | Clear. |
| 23 | 25 | 39 | 30.3 | 30.3 | S. W. | W. | | Clear. |
| 24 | 29 | | 30.3 | | S. W. | W. | Cloudy. | |
| 25 | 47 | 49 | 29.8 | 29.8 | S. | S. W. | | Clear. |
| 26 | 38 | 43 | 30. | 30. | N. W. | N. E. | | |
| 27 | 38 | 43 | 30. | 30.2 | N. E. | N. E. | Cloudy. | Cloudy. |
| 28 | | | | | | | | |
| 29 | 36 | 48 | 29.9 | 29.8 | N. E. | N. E. | Cloudy. | Cloudy. |
| 30 | 39 | 42 | 29.9 | 29.7 | N. E. | N. E. | Rain. | Rain. |
| 31 | 39 | 48 | 29.8 | 29.8 | N. W. | N. W. | Cloudy. | Clear. |

* Thermometer in open air this morning, at 7 A. M. at near 6°.

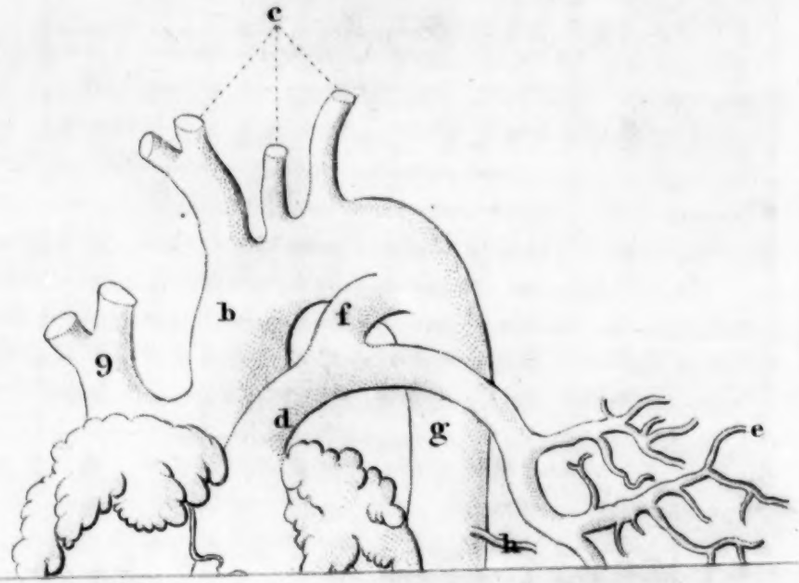
☞ It is requested that communications intended for the Medical Recorder, may reach the Editor by the 1st of the month preceding the day of publication.

### ERRATA.

Page 30, (note,) for "*Howard*," read "Hansard."
31, line 1, for "*from*," read "for."
35, (note,) for "*Malagenta*," read "Malageuta."
36, line 5, after "of," add "our."

# Plan of the Fœtal Circulation

*References made by W.E.Horner M.D.*




REFERENCE

a. *Right ventricle of the heart*

b. *The curve of the aorta*

c. *The arteria innominata left carotid & left subclavian*

d. *Pulmonary artery*

e. *Ramifications of left branch of*

*the bladder up to the navel being the proper umbilical artery the dotted lines represent the course of the umbilical artery on the other side of the Bladder*

*The artery from each*

gg. *Trunk of the aorta descending*

h.h.h.h.h. *Intercostal arteries*

i. *Phrenic artery*

k. *Cœliac artery*

l. *Superior mesenteric artery*

m. *Emulgent artery*

nn. *Spermatic artery*

o. *Inferior mesenteric artery*

p. *Primitive iliac*

qq. *External iliac artery which is seen dividing into two branches the shorter goes to the lower extremity the longer runs on the side of*

2. *Mesenteric veins forming by their junction the vena Portarum*

3. *Branches of vena portarum in the Liver*

4. *The sinus of the vena Portarum*

5. *Ductus venosus*

6. *Left hepatic vein*

7. *Right hepatic vein*

8.8.8. *Ascending cava*

9. *Descending Cava*

*Philadelphia*

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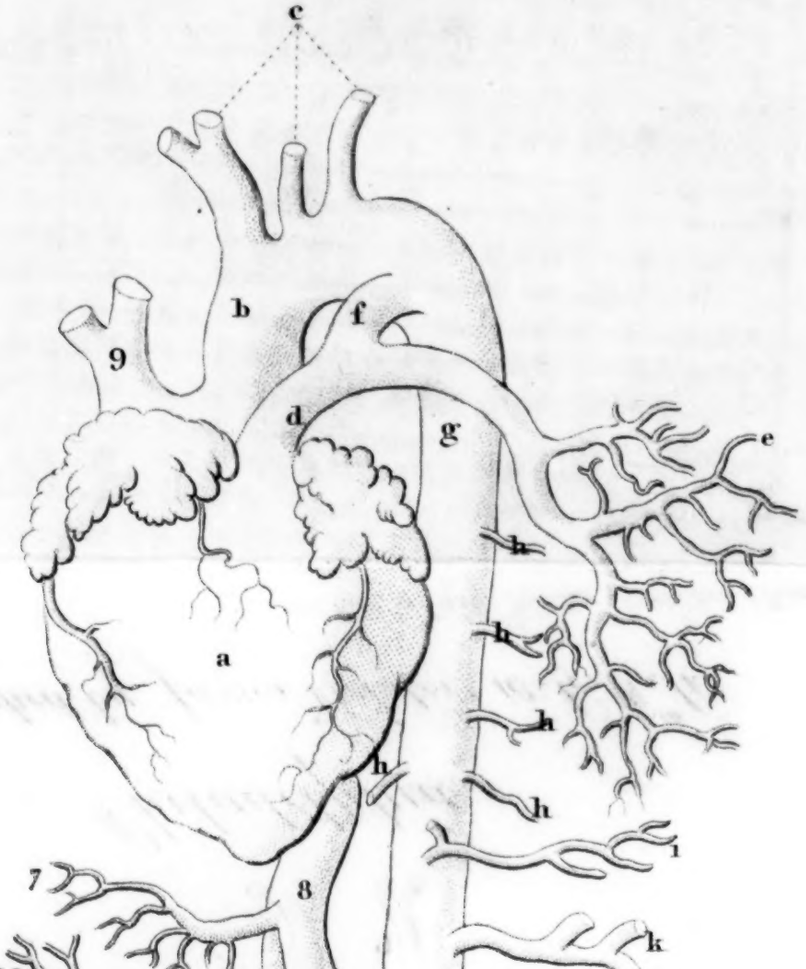


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a. *Right ventricle of the heart*

b. *The curve of the aorta*

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d. *Pulmonary artery*

e. *Ramifications of left branch of Pulmonary artery*

f. *The ductus arteriosus making a communication between the pulmonary artery and the aorta*

gg. *Trunk of the aorta descending*

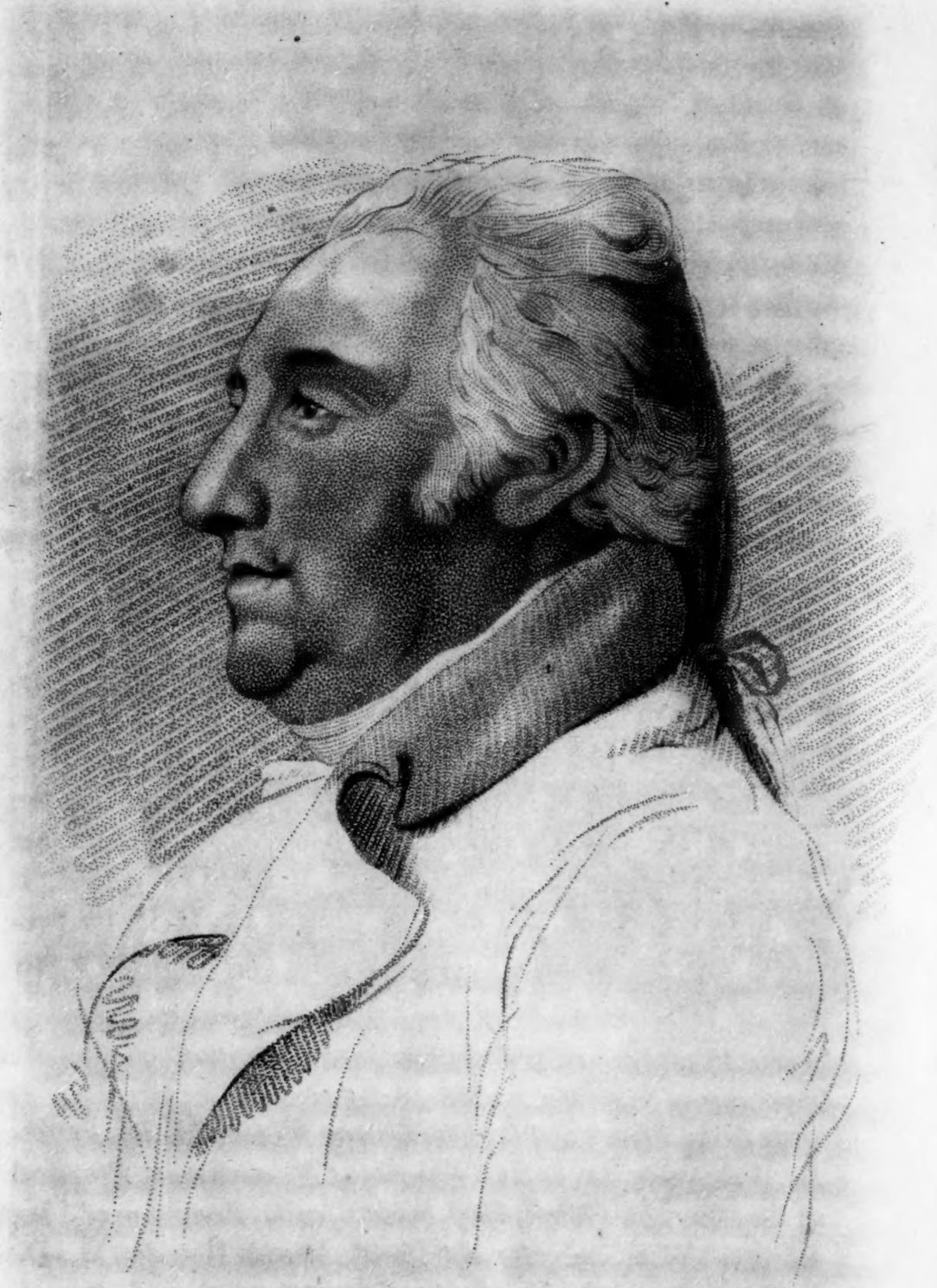
*the bladder up to the navel being the proper umbilical artery the dotted lines represent the course of the umbilical artery on the other side of the Bladder*

*The artery from each side is seen twisted around the umbilical vein forming with it the umbilical chord*

r. *The bladder*

Fig.1. *Umbilical vein*

2. *Mesenteric veins forming*



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